NINTH AND TENTH GRADE STUDENTS’ MATHEMATICS SELF-EFFICACY BELIEFS:
THE SOURCES AND RELATIONSHIPS TO TEACHER CLASSROOM INTERPERSONAL
BEHAVIORS

by

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A DISSERTATION

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ABSTRACT

The purpose of the mix-methods action research study was to seek how the changes in students’ perceptions about teacher classroom interpersonal behaviors, the four efficacy sources and mathematics self-efficacy beliefs were related. The methods used to accomplish this were: descriptive statistics, t-test, Pearson correlation coefficient statistical analyses, focus group interviews and a practical argument analysis. The investigation was three-fold: 1) determine students’ perceptions of teacher classroom interpersonal behaviors and the sources of their mathematics self-efficacy changes during the academic semester; 2) investigate how those changed perceptions affected any existing relationships among and between students’ perceptions of mathematics self-efficacy beliefs, Bandura’s four sources of those beliefs, and teacher classroom interpersonal behaviors; and 3) reflective focus on researchers’ teaching beliefs and strategies of self-efficacy within the mathematics classroom. Post mean scores indicated that perceived Verbal Persuasion as the most influential source of their mathematics self-efficacy and a significant positive relationship between Verbal Persuasion and efficacy beliefs toward future success in mathematics courses. Pearson correlation coefficient analysis revealed perceptions of teacher classroom interpersonal behaviors were shown to have significant relationships to the four sources of mathematics self-efficacy beliefs. Practical argument analysis provided evidence that the researcher’s teaching beliefs were aligned with the four sources of self-efficacy. The significant relationships between Bandura’s (1997) four sources of self-efficacy and teacher classroom interpersonal behaviors requires further investigation to illuminate how these relationships may affect mathematics self-efficacy.
DEDICATION

This dissertation is dedicated to my father, Walter Eugene Garrett (1928-1997), whose love of education was only surpassed by his love of The University of Alabama.
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CHAPTER 1

INTRODUCTION

Increasingly, the mathematics proficiency of all students within the United States continues to be a substantial challenge for mathematics educators. In 2003, findings from The Trends in International Mathematics and Science Study (TIMSS) revealed that eighth grade students in the United States scored significantly lower than the eighth grade students of five Asian countries (Chinese Taipei, Hong Kong SAR, Japan, Korea, and Singapore), and four European countries (Belgium-Flemish, Estonia, Hungary, and the Netherlands) (Gonzalez, P., et al., 2004). The United States is one of three countries (i.e. the other two, Australia and Canada) that lacks a national mathematics curriculum, lacks consequences for students not meeting national mathematics standards, and lacks a national time consensus for instruction of mathematical concepts. These deficiencies challenge the United States to explore alternative ways of enhancing greater student success when competing in the global mathematical society. One alternative to these deficiencies is to look at the important role of mathematics self-efficacy in the classroom. This present study investigated the perceived mathematics efficacy beliefs among 9th and 10th grade students; specifically, the role that the teacher-student relationship plays in that perception.

Background

Much of the investigation concentrating on the influence of self-efficacy beliefs has focused on students’ achievement (Lent, Brown, & Larkin, 1984; Meier, McCarthy, & Schmeck,
1984; Norwich, 1987; Schunk, 1987; Wood, & Locke, 1987; Brown, Lent, & Larkin, 1989; Pajares, & Miller, 1995). However, mathematics educators are looking to other disciplines for guidance in increasing student mathematical proficiency. For instance, cognitive researchers tell us that an important component of increasing students’ mathematical proficiency should include assessing students’ mathematics self-efficacy beliefs (Bandura, 1997; Pajares, 1997). For example, Hanlon and Schneider (1999) reported on a study that involved an intervention designed to improve students’ mathematics proficiency through a self-efficacy training program. The program included students making self-efficacy judgments on daily quizzes to compare with scores achieved on those quizzes, to identify short term goals, and to maintain self-monitoring forms and a math heuristic. The results of this study revealed that over time students’ achievement scores on a math proficiency test showed significant improvement, as well as students’ efficacious beliefs in achieving a passing grade.

Self-efficacy beliefs, particularly in mathematics, are quite complex. The influencing determiners in constructing self-efficacy beliefs include the student’s perception of their performance accomplishments, the vicarious experiences produced by peers and influential adults, the role of societal persuasions, and the emotional states occurring at any given time during mathematical involvement (Bandura, 1977).

Performance accomplishments, considered especially influential, are predictors for students’ perceived ability levels among specific mathematical tasks, in this case, among their mathematical tasks. This perceived level of ability can be influenced by other factors that are also responsible for providing efficacy determinations (i.e. vicarious experience, social persuasion, and/or emotional/physiological states). For instance, students who observe their peers perform a self-perceived difficult mathematical task may question their own perception of
an acceptable level of performance accomplishment (Bandura, 1997). Performance accomplishments perceptions can be compounded by verbal and/or non-verbal social suggestions. For example, students’ perception of their ability for successfully completing a specific mathematical task can be positively or negatively affected by others’ verbal comments on their performance of that task. Student’s physical behavior and/or emotional responses can be interpreted as a positive or negative motivational stance toward a specific performance accomplishment during mathematics tasks. Specifically, students’ increased heart rate during the performance of a specific mathematics task could be interpreted as excitement or anxiety toward that task which, in turn, could change the student’s perception of their performance accomplishment (Bandura, 1977, 1997).

There is conflicting research suggesting not all of Bandura’s influential sources affects individual mathematics self-efficacy beliefs. Matsui, T., Matsui, K., and Ohnishi (1990) found three of the determiners (i.e. performance accomplishment, vicarious experience, and emotional-physiological states) significantly influenced students’ mathematics self-efficacy beliefs, while social persuasion was not a significant influence.

In similar research, Lent, Lopez, and Bieschke (1991) used an instrument designed to measure the four sources of self-efficacy. Results revealed performance accomplishment as the only significant relationship between the sources and self-efficacy. Usher and Pajares’ study (2006) concluded all four sources predicted academic self-efficacy, though not all subjects within their study reported those sources as significant. They found that females of both races (i.e. White, African-American) identified performance accomplishment and social persuasion as the strongest influences, while males cited performance accomplishment and vicarious experience as most influential toward mathematics self-beliefs. Interestingly, African American
students of both genders and only White females reported social persuasion as being more influential than their performance accomplishments; low-performing students in this same category sited physiological-emotional states as influential over self-efficacy beliefs. White males identified performance accomplishments as the most important influence toward their mathematical self-efficacy.

These conflicting results provide evidence that race, gender, and low-levels of mathematics performance can be determining factors of which source exerts the most influence. Matsui, Matsui, and Ohnishi (1990) did not find social persuasion to be significantly influential. Lent, Lopez, and Bieschke (1991) reported performance accomplishments as the only influential source. But, Usher and Pajares (2006) found social persuasion and performance accomplishments to be equally influential among White and African-American males and females.

Sources of Self-Efficacy and Teacher Classroom Interpersonal Behaviors

Research has indicated that the classroom teacher’s behavior and level of support provided to students may be influential sources of self-efficacy (e.g. Midgley, Feldlaufer, & Eccles, 1989; Pianta, 1999; Rogers & Freiberg, 1994). Viau (1999) conducted a study where students often named teachers as the influential source of their motivational attitudes for a specific subject. Other studies posited a strong correlation between teacher/student interpersonal relationships as an important indicator regarding student motivation and achievement (Connell, & Wellborn, 1991; Deci, & Ryan, 1985; Ford, 1992; Kozecki, 1985; Kozecki & Entwisle, 1984; Ryan, & Deci, 2000). In addition, the interpersonal relationships between teachers and students have been shown to be significantly related to the influential strength of the source, verbal persuasion (Connell, & Wellborn, 1991; Wentzel, 1994).
Bandura (1977) is credited with the four sources of self-efficacy. Those sources include performance accomplishments, vicarious experience, verbal persuasion, and emotional-physiological states. Considered the most influential source, Performance accomplishments are predicated by the student’s perception of their performance. Vicarious experience exerts efficacy influence when students acknowledge similarities with the person successfully performing a mathematical task. Verbal persuasion refers to the positive or negative influence that others, particularly teachers, can wield through their evaluations on students’ performance (Klassen, 2004; Usher & Pajares, 2006). Specific academic tasks can trigger emotional or physical reactions, referred to as emotional-physiological states, which can positively or negatively affect students’ perceptions of ability (Usher & Pajares, 2006). All of Bandura’s sources of self-efficacy relate to students’ perception of their ability to perform specific task.

Performance accomplishments, touted the most influential of the four sources, is influenced by the student’s perception of their performance (Hampton, 1998; Klassen, 2004; Lent, Brown, Gover, & Nijjer, 1996; Lent, Lopez, & Bieschke, 1991; Lent, Lopez, Brown, & Gore, 1996; Lopez & Lent, 1992; Matsui, Matsui, Ohnishi, 1990). Students’ personal perceptions of performance are associated to comparison with peers.

Often cited as an interrelated experience to performance accomplishment, vicarious experience can be influenced by the teacher-student relationship. For example, students who perceive their teacher’s behavior as helpful/friendly, understanding, and allowing for student responsibility/freedom will be more willing to demonstrate their performance publicly. In contrast, students who perceive their teachers as strict, admonishing, and uncertain will be hesitant to publically display their performance in fear of ridicule, embarrassment, and uncertainty about acceptable mastery level.
Bandura maintains that different types of modeling provide students with efficacy information. Expert modeling, especially strategic modeling (modeling that includes verbalization of strategy and procedure), has been shown to be effective with students of little to no experience with the related task (Bandura, 1997). Although multiple demonstrations by peers of vicariously perceived similarity (i.e., competence, age, sex, race) affect students’ self-efficacy, students’ perception of their teacher’s modeling has been reported to be equally influential to students’ success or lack of success in the classroom (Schunk, Hanson, & Cox, 1987; see also Garmezy, 1994; Osterman, 2000; Pianta, 1999).

Verbal persuasion, Bandura’s third source, is defined as the verbal and/or socially contextual messages students may use to form new perceptions of their abilities. The strength of influence provided by verbal persuasion could be affected by students’ perception of their teacher’s leadership, certainty, and trustworthy behaviors. Teachers hold influential persuasion over students’ performance accomplishments, regardless how their behavior is perceived by students. Teachers who are perceived as admonishing, strict and uncertain may inhibit the mathematics performance success of students (Garmezy, 1994; Osterman, 2000; Pianta, 1999).

Emotional-physiological states, Bandura’s fourth source, refer to the emotional and physiological reactions that students experience when faced with specific tasks. For instance, mathematics anxiety, a much researched phenomenon, is an ability performance indicator for many students. Students’ perception of teacher classroom interpersonal behaviors can contribute to their feelings of mathematics anxiety. According to Hadfield and McNeil (1994), the causes of math anxiety can be divided into three categories: 1) environmental, 2) intellectual, and 3) personality factors. The environmental factors include negative classroom experiences and students’ perception of insensitive instructors. Students who perceive their teachers as exhibiting
dissatisfied, admonishing, overly strict and uncertain classroom behaviors, may continue to stay in a state of mathematical anxiety. Students who perceive their teachers as exhibiting helpful/friendly, understanding and leadership behaviors, may experience reduced levels of mathematical anxiety.

Purpose of Study

Classroom environment research has provided evidence that significant relationships exist between classroom environments and various cognitive and affective outcomes (Fraser, 1986; Fraser & Fisher, 1982; Haertel, Walberg, & Haertel, 1981). Lorsbach and Jinks (1999) advocated that further research is necessary to explore the phenomena between classroom environments and student’s self-efficacy beliefs. The authors suggested it was “apparent that growth in student autonomy is at the intersection of learning environment and self-efficacy research and could hold some promise for transforming student perceptions of classroom learning environments” (Lorsbach, & Jenks, 1999, p. 164). In response, Dorman (2001) investigated associations between classroom psychosocial environments and academic efficacy. Using a multivariate correlation analyses, results revealed statistically significant relationships between classroom environment and academic efficacy, noting that one of the significant relationships was teacher support.

Additional studies focused on the relationships found among teacher-student communication, is learning environment and student performance to explore their corresponding degree of influence. For example, Kim, Fisher, and Fraser (2000) surveyed 543 eighth graders from 12 different schools in Korea using the What is Happening in this Class (WIHIC) and the Questionnaire on Teacher Interaction (QTI) instruments. Simple correlation coefficients revealed positive associations among the classroom environment, teacher interpersonal behavior
and students’ attitudes toward science. Another study investigated the chemistry laboratory classroom environment, teacher interpersonal behavior, and student attitudes toward chemistry. Data were collected from 497 gifted and non-gifted secondary-school students in Singapore using the Chemistry Laboratory Environment Inventory (CLEI), the Questionnaire on Teacher Interaction (QTI), and the Questionnaire on Chemistry-Related Attitudes (QOCRA) surveys. Both the laboratory classroom environment and teacher interpersonal behavior were found to have a significant relationship to students’ attitudes toward chemistry. This influential communicative/performance relationship has pushed the boundaries of past research investigating classroom learning environments related to the perceptions of students and teachers (Fraser & Walberg, 2005).

Wubbels and his colleagues designed a model to investigate the importance of teacher interpersonal behavior during classroom instruction (Wubbels & Brekelmans, 1998; Wubbels & Levy, 1993). Wubbels et al.’s design, based on Leary’s (1957) interpersonal design, focused on diagnosing teacher personality and applicable influences to classroom teaching. The redesigned model, referred to as the Model for Interpersonal Teacher Behavior (MITB), (see Figure 1), interconnects two continuum dimensions: Influence (Dominance---Submission) and Proximity (Opposition---Cooperation), (Wubbels & Brekelmans, 2005; Wubbels, Brekelmans, den Brok, & Tartwijk, 2006; Wubbels, Créton, & Hooymayers, 1985).
The interconnecting dimensions, represented by a coordinate system divided into eight sections, maps the graphical image of teacher behavior within the classroom. The Influence dimension measures the level of control students believe the teacher has over the communication in the classroom; the Proximity dimension measures the affinity that students perceive occurs within the communication process (Lang, Wong, & Fraser, 2005). The octagonal sections describe a continuum of eight different behavior characteristics: DC (Leadership), CD (Helping/Friendly), CS (Understanding), SC (Student Responsibility/Freedom), SO (Uncertain), OS (Dissatisfied), OD (Admonishing) and DO (Strict).
Wubbels, Brekelmans, and Hoymayers (1991) remarked that “every instance of interpersonal teacher behavior can be placed within the system of axes. The closer the instances of behavior are in the chart, the more closely they resemble each other” (p. 142). The teacher-student relationship in this study was measured by student perception of the eight interpersonal behaviors defined by the Model of Teacher Interpersonal Behavior (Wubbels, Brekelmans, den Brok, & Tartwijk, 2006) (see Figure 1).

Supported by two decades of teacher interpersonal behavior research, Wubbels and Brekelmans (2005) conclude that “[c]lassroom environmental studies that have included the interpersonal perspective on teaching usually indicated a strong and positive relationship between perceptions of Influence and Proximity or their related subscales and cognitive and affective student outcomes” (p. 12). The need for exploring teacher interpersonal behaviors to identify its possible correlations with students’ mathematics self-efficacy beliefs warranted further investigation. The purpose of this study was to investigate whether within-year changes of students’ perceptions regarding teacher interpersonal behaviors, sources of efficacy influence, and mathematics self-efficacy beliefs were related.

**Statement of the Problem**

Classroom mathematics teachers are cognizant of the potential influence they can have on their students and most have a working knowledge of self-efficacy. However, due to the lack of research focused on the strong associations between teacher classroom interpersonal behaviors and students’ mathematics self-efficacy beliefs, it is reasonable to state that most teachers are unaware of how much influence their interpersonal behaviors can have on students’ efficacious beliefs. Applying Bandura’s (1977) self-efficacy sources, this study explored how the teachers’ classroom interpersonal behaviors inform students’ mathematics self-efficacy beliefs.
The transition period from junior high school to high school for low efficacy students can result in a shaky start within the high school mathematics classroom. These students are adjusting to a new school, all new teachers, and increased academic responsibilities. It is reasonable to expect mercurial-like changes in perceptions of abilities, sources of influence and teacher interpersonal behaviors. For example, in a study on motivation by Corpus, McClintic-Gilbert and Hayenga (2009), within year changes of student perceptions, were studied. These authors argued,

A final ambiguity about the timing of developmental change arises, then, because motivation is typically measured only once each academic year. In these cases, theoretically important school experiences that occur during the academic year are confounded with those that result from moving up a grade, working with new teachers, being exposed to a new curriculum with different grading practices, and often entering a new school….In short, relying exclusively on between-year comparisons in motivation may obscure the temporal location of change. (p.155)

This study’s purpose was to look for those “temporal locations of change” that may exist among and between students’ mathematics self-efficacy beliefs, the sources of those beliefs, and teacher classroom interpersonal behaviors.

Research Questions

For more than a century, educators have searched for defining qualities of an effective teacher (Borich, 1988). Noted learning environmental researchers, Wubbels, Levy, and Brekelmans (1997), defines an effective teacher:

Many educators today hold to the view that effective teaching can be defined in terms of a plethora of technical strategies, such as choice, organization, and presentation of
teaching materials; motivational strategies; and assessment. Our view of teaching
effectiveness comes from a different—yet complementary—perspective. While
instructional methodology is an important consideration, exceptional teaching can
also be described in terms of teacher-student relationships. (p. 82)

The four questions in this study were framed to explore whether a teacher-student
relationship has a communicative influence between students’ attendance to particular
informational sources of self-efficacy and their mathematics efficacious beliefs. Similarly, the
author explored whether students believe that their levels of mathematics performance
accomplishments and self-efficacy beliefs are determined within the classroom environment.

The four questions guiding the investigative tenor of this study are:
1.) What changes, if any, occur in ninth and tenth grade students’ pre-and post perceptions of
    Bandura’s four sources of mathematics self-efficacy?
2.) What changes, if any, occur in ninth and tenth grade students’ perceptions of the
    teachers’ interpersonal classroom behaviors?
3.) How do the changes in perceptions affect the relationships that may exist among ninth and
teneth grade students’ perceptions of their mathematics self-efficacy beliefs, the sources of
those beliefs, and their teachers’ interpersonal classroom behaviors?
4.) How are Bandura’s four sources of self-efficacy addressed during one ninth grade’s
    Algebra I classroom instruction?

The first question investigated the changes of students’ perceptions toward Bandura’s
(1977) sources of self-efficacy. The second question investigated the changes in students’
perceptions of their teachers’ classroom interpersonal behavior. The third question investigated
how those perceptual changes among students’ mathematics self-efficacy beliefs, the four
efficacy sources, and teachers’ interpersonal behaviors are related. The fourth question explored one teacher’s classroom practices and interpersonal behavior with regard to Bandura’s (1977) four sources of self-efficacy beliefs.

Methodology

This was an action research study on the influence of teacher classroom interpersonal behavior, mathematics self-efficacy beliefs, and their sources on ninth-and tenth grade mathematics classes in a rural county high school in Southwest Alabama. The study’s design comprised of three-phase concurrent mixed methods for data sources, collection, and analysis, and categorization into congruent relationships. Johnson and Onwuegbuzie (2004) define mixed methods research “as the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts, or language into a single study” (p. 17). Collins, Onwuegbuzie, and Jiao (2006) categorizes data collection as concurrent when data from, “one phase do not inform the data collected in the other phases until the data interpretation phase occurring at the study’s conclusion” (p. 88).

The decision to use mixed methods for this study was based on two major factors: 1) notable scholars from the teacher-student relationship research community (Fraser, 1998a; den Brok & Levy, 2005; Rickards, den Brok, & Fisher, 2005) calling for the use of qualitative methods in future research utilizing the QTI survey, and 2) the belief that a mixed methods research design will provide the most complete picture in teacher-student relationship interest. Additionally, utilization of quantitative and qualitative primary and secondary data sources triangulated the three-phase concurrent analysis of relationships data.

The choice of using a self-study action research method was a process in which the researcher as a classroom teacher expected to greatly benefit her classroom teaching. For
instance, Berry (2004) suggests that, “Teacher educators engaging in self-study commonly share a broad motivation to improve the experience of teacher education through improving their teaching practice” (p. 1308). Hamilton and Pinnegar (1998) believe that action research can develop new understandings and provide practicing teachers further knowledge about their teaching, advocating that “[f]ormalizing such study of practice through self-study is imperative…” (p. 243). Loughran (2007) envisions a quality self-study as a disciplined and systematic inquiry which values professional learning as a research outcome and has the capability of developing and articulating that outcome to fellow teachers, as well as to teacher educators.

Data Sources

Originating in the Netherlands, a Dutch-language version of the Questionnaire on Teacher Interaction was developed in the early 1980’s (Wubbels, Créton, & Hooymayers, 1985; Brekelmans, 1989). The American version of the Questionnaire for Teacher Interaction (QTI) (Wubbels & Levy, 1991), developed in the late 1980’s, was used for this study. Additionally, the Mathematics Self-Efficacy Survey-Revised (MSES-R) (Betz & Hackett, 1983) and the Sources of Mathematics Self-Efficacy Scale (SMSES) (Lent, Lopez, & Bieschke, 1991) were used to collect quantitative data. Practical argument of video-taped lessons and focus group interviews were used for the qualitative data collection and analysis. The focus groups were determined by quantitative data.

The first data collection phase consisted of assessing the self-efficacy beliefs, students’ perceptions of their most influential efficacy source(s), and their conceptions of the teacher-student relationship of all ninth and tenth grade participating students with the MSES-R, the SMSES, and the QTI. The second phase included the video-taped lessons, organization of the
focus group, selection of one Algebra 1A class for qualitative study, administration of pre-test questionnaires, and analysis of pre-test questionnaire for the development of the first focus group interview protocol. The third phase included the post administration of all three survey instruments, follow-up focus group interview, and the transcription and coding of the practical argument. Table 1 describes the timeline for this study.

Table 1

*Timeline of Study*

<table>
<thead>
<tr>
<th>Phase</th>
<th>Description of Data Collection</th>
<th>Timeline</th>
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<tbody>
<tr>
<td>Phase 1</td>
<td>Parent consent and student assent forms distributed and collected from study participants</td>
<td>5 weeks</td>
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<td></td>
<td>Participant demographic information were collected</td>
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<td></td>
<td>Pre-administration of the MSES-R, QTI, and the SMSES</td>
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<tr>
<td>Phase 2</td>
<td>Organized focus groups 1&lt;sup&gt;st&lt;/sup&gt;, 2&lt;sup&gt;nd&lt;/sup&gt;, and 3&lt;sup&gt;rd&lt;/sup&gt; video taping of all 3 classes</td>
<td>16 weeks</td>
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<tr>
<td></td>
<td>Selection of Representative class for qualitative study</td>
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<td></td>
<td>Bi-weekly video tapings of Representative class</td>
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<td></td>
<td>Pre-test Questionnaires were administered</td>
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<td></td>
<td>Questions and discussion points for focus group interviews were identified and developed from pre-test questionnaire data analysis</td>
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</table>
Focus group interviews (2)

Selection of video tapings to be used for practical argument

Phase 3

Post-Administration of the MSES-R, QTI, and 6 weeks

the SMSES

Follow-up focus group interview

Transcribing practical argument for coding and categorization

Significance of the Study

More and more studies concur that student perceptions of their learning environment influence academic and social motivation, self-beliefs, academic learning strategies, engagement in learning activities, help-seeking behaviors, achievement outcomes, and emotional functioning (Kuperminc, Leadbeater, Emmons, & Blatt, 1997; Roeser, Eccles, & Sameroff, 1998; Ryan, Gheen, & Midgley, 1998; Turner et al., 2002; Wentzel, 1997). The classroom teacher is considered to be one of the significant factors affecting a student’s perception of the learning environment (Ferreira & Bosworth, 2001). The teacher-student relationship is recognized as one of the best predictors of students’ effort and engagement in the classroom (Osterman, 2000).

More than 30 years of research on students’ learning motivations, Stipek (2006) proclaims that “when students have a secure relationship with their teachers, they are more comfortable taking risks that enhance learning—tackling challenging tasks, persisting when they run into difficulty, or asking questions when they are confused” (p. 46). Stipek’s relationship reflects an earlier description of self-efficacy’s influence.
Pajares (1996) describes the influence of efficacy beliefs as a determinant of the effort students will expend on an activity, the persistence they demonstrate when confronting obstacles, and their resilience in response to adverse situations. The symmetrical nature of the teacher-student relationship and students’ mathematics self-efficacy beliefs is significant to this study’s purpose.

This classroom action research was designed to address these very real obstacles to helping students reach their optimal perception of their mathematical ability. During the course of a regular school day, it is impossible to ignore students’ discussions of their perceived ability deficiencies or miss the looks and sounds of frustration that are commonplace within the high school mathematics classroom. The research questions of this study were formed with the premise that students’ self-efficacy beliefs are associated with their perception of their teacher’s classroom interpersonal behavior and that changes in either of these perceptions would affect the other. Maximizing students’ learning potential is important to instructors and researchers of all levels of education and self-efficacy belief has been described as “the key factor of human agency” (Bandura, 1997, p. 3), therefore, the perception is that all factors which might contribute to the formation of positive efficacy beliefs should be investigated.

Assumptions

These following assumptions in the study are:

1. Each participant responded honestly and thoughtfully to all surveys, questionnaire and interview questions.

2. The perceptions expressed by all participants through the questionnaire and focus group interviews will be students’ accurate perceptions of the teacher’s interpersonal behavior.
3. The results from this action research study will provide mathematics educators valuable information that is relevant to their classrooms.

Definitions

Emotional-physiological states - Students that experience fear, anxiety, stress, or other physiological responses to difficult tasks are subject to evaluate their efficacy beliefs based on these emotional arousals (Bandura, 1977). Bandura (1977) originally used the term ‘emotional states’ for this concept, but later changed it to ‘physiological states’ (Bandura, 1997). I have chosen a combination of these two terms (i.e. emotional-physiological states) because both terms are necessary to adequately describe the concept of how emotional reactions within the mathematics classroom can be responsible for physiological responses. This study will explore the ways in which their fears and emotions are dealt with in the classroom.

Performance accomplishments – “This source of efficacy information is especially influential because it is based on personal mastery experiences” (Bandura, 1977, p.195). In practical terms, efficacy identification derives from the student’s perception of their previous successes or failures with that task or related tasks. I choose to use performance accomplishments, which was Bandura’s (1977) original terms, instead of the later term of efficacy research, mastery experience. My choice was predicated on my belief that the term mastery experience brings to mind a specific level of accomplishment; whereas, performance accomplishment brings to mind a more individualistic level of accomplishment.

Self-efficacy - A person’s belief in their ability to perform specific tasks with an acceptable level of competence. These beliefs determine the way that people feel, think, self-motivate and behave (Bandura, 1994).
Social persuasion - Students “are led, through suggestion, into believing they can cope successfully with what has overwhelmed them in the past” (Bandura, 1977, p. 198). The formation of self-efficacy beliefs depends on the student’s ability to evaluate their performances. Those students who have difficulty with this evaluation will depend on others to provide these assessments.

Teacher classroom interpersonal behaviors – consists of all the interpersonal actions (verbal and non-verbal communications), “which create and maintain the classroom atmosphere” (Wubbels & Levy, 1993, Introduction Section). In this study, teacher interpersonal behavior refers to the students’ perception of the teacher-student relationship.

Teacher-student relationship- is the relationship defined by the measurement of students’ perceptions of their teachers’ interpersonal behavior. “The model for interpersonal teacher behavior has two dimensions characterizing the teacher-student relationship: Influence (Dominance-Submission) and Proximity (Opposition-Cooperation). The two dimensions underlie eight types of teacher behavior: leadership, helpful/friendliness, understanding, giving students freedom and responsibility, uncertainty, dissatisfaction, admonishing and strictness” (Wubbels, 2005, p. 2).

Vicarious experience - When students similarly identify with those others that are successfully performing challenging tasks, then this can have a positive influence on their own efficacy beliefs (Bandura, 1986, 1997; Schunk, 1987).
CHAPTER 2

LITERATURE REVIEW

Introduction

This chapter presents a review of the literature associated with the proposed study regarding the teacher-student relationship and its influence over students’ mathematics self-efficacy beliefs. The review includes two broad bodies of literature which provides the theoretical framework guiding this investigation. The first body of literature focuses on self-efficacy beliefs and its supporting source determiners. The second body of literature highlights epistemological sources with the teacher-student relationship construct. Within each of the two bodies of literature, specific sections present supporting research relating to the five questions guiding the proposal.

Self-Efficacy

Cognitive learning theorists define self-efficacies, “as a sense of confidence regarding the performance of specific tasks” (Bandura, 1986; Lorsbach, & Jinks, 1999, p. 158). In particular, Bandura’s seminal work defined self-efficacy as “people’s judgments of their capabilities to organize and execute courses of action required to attain designated types of performances” (p. 391). Bandura’s definition suggests that if cognition were the engine of intellectual behavior, then self-efficacy beliefs would be the fuel.

Linnebrink and Pintrich (2003) distinguish self-efficacy from a student’s awareness of their self-concept by describing it as beliefs that are “much more specific and situational
judgments of capabilities” (p. 121). This study defined self-efficacy as a student’s belief in their personal ability to perform certain specific mathematical tasks.

Overview of Self-Efficacy Research

Self-efficacy beliefs has been studied in a variety of disciplines and settings that have been thought to influence how an individual believes and acts within specific situations. For instance, phobias (Bandura, 1983), addiction (Marlatt, Baer, Quigley, 1995), forms of depression (Davis & Yates, 1982), abilities of social skills (Moe & Zeiss, 1982), levels of assertiveness (Lee, 1983, 1984), stressful encounters (Jerusalem & Mittag, 1995), smoking behaviors (Garcia, Schmitz, & Doerfler, 1990), psychological and physiological pain control (Manning & Wright, 1983), health issues (O’Leary, 1985), and degrees of athletic sports performance (Barling & Abel, 1983; Lee, 1982) are each a potential determiner of self-efficacy. Within the educational community, researchers have concentrated on three major self-efficacious areas of influence: College majors that foreshadow a career choice; a classroom teacher’s efficacious beliefs; and, classroom students’ academic performance and achievement abilities (Pajares, 1997).

College Major Choice and Career Indecision

There have been numerous studies that have focused on the influence of efficacious beliefs on college major choice and career indecision. For example, Betz and Hackett (1983) suggest that self-efficacy perception plays a major role in influencing educational and career decisions. Similarly, Taylor and Betz (1983) reported a direct relationship between the levels of self-efficacy belief and the levels of career indecision. Other factors beyond career decisiveness that are considered essential to successfully obtaining the vocation of choice are perception of career options and persistence in the chosen educational program. Research has found strong evidence linking self-efficacy beliefs to both of these factors (Betz & Hackett, 1981; Lent,
Brown, & Larkin, 1984). Specifically, Lent, Brown, and Larkin (1986) found self-efficacy to be a stronger predictor of technical grades, persistence in the program, and range of career options over objective math ability, high school achievement and vocational interest. The one thread that seems to run throughout each of the studies cited above is that highly efficacious students made more career decisions, perceived more extensive career options, and persisted toward their educational aspirations; students with low self-efficacy beliefs were less decisive, perceived more career option limitations, and were less persistent in their educational aspirations (Betz & Hackett, 1983; Lent, Brown, & Larkin, 1984, 1986; Taylor & Betz, 1983).

Teachers’ Sense of Efficacy

Another area of interest within the cognitive self-efficacy domain is teachers’ judgments of their capability to bring about positive learning outcomes for their students, referred to as a teacher’s sense of efficacy (Armor et al., 1976; Ashton & Webb, 1986; Moore & Esselman, 1992; Ross, 1992). Supported by the research below, teacher sense of efficacy is defined as the belief that student achievement can be positively affected by the learning environment created and maintained through the learning activities and experiences provided to students.

Teachers are responsible for creating an encouraging learning environment within their classrooms. For example, Bandura (1993) advocates that an important component necessary for creating these learning environments is the teacher’s belief in their personal and professional instructional efficacy. Teachers’ efficacy beliefs are related to their classroom behavior in the effort put forth toward teaching, the classroom and professional goals set, and their level of aspiration (Tschannen-Moran & Hoy, 2001). Teacher efficacy studies have indicated that those classroom teachers with high instructional efficacy beliefs devote more classroom time to academic learning, attempt to provide successful one-on-one instruction with students having
difficulty learning, and provide consistent meaningful feedback for student accomplishments (Gibson & Dembo, 1984). Similar studies have investigated teacher efficacy beliefs in relation to content area confidence. Aston (1985) and Aston and Webb (1986) reported that teachers with high confidence in a particular content area hold a more positive teaching efficacy to create instructional accommodations that would meet the needs of a diverse learning ability classroom. These highly efficacious teachers confidently engage with diverse achieving students’ needs that influence a greater number of their students to succeed academically.

Within a particular content area, studies that focused specifically on teacher’s efficacy beliefs in teaching science and mathematics have found those beliefs to be an important confidence factor in determining instructional practices and students’ academic achievements (Haney & Lumpe, 1995; Lumpe, Haney, & Czerniak, 2000; Smith, 1996; Tosun, 2000). For example, in a study examining teacher candidates’ efficacy beliefs in the teaching of science during their elementary education teaching program, Cantrell, Young, and Moore (2003) recommended that teacher preparation programs should concentrate their efforts on improving confidence among elementary teacher candidates’ science teaching efficacy beliefs. These authors specifically argued that early field experiences for pre-service teachers that include science lesson plan development and delivery for sustained periods of time would result in elevating the teaching efficacy of candidates. The results from teacher sense of efficacy studies suggest that in addition to students’ self efficacy beliefs about learning and confidence outcomes, the level of academic success is influenced by the classroom teacher’s content area level of confidence (Anderson, Greene, & Loewen, 1988; Armor et al., 1976; Ashton & Webb, 1986; Moore & Esselman, 1992; Midgley, Feldlaufer, & Eccles, 1989).
Student Academic Performance and Achievement

There are an abundance of studies seeking the relationship between student self-efficacy beliefs and students’ academic performance and achievement. Particularly, in a study of 56 middle grade students identified as having experienced profound failure in mathematics, Schunk (1981) demonstrates that cognitive modeling increases students’ division skill through the enhancement of their self-efficacy beliefs. Cognitive modeling refers to adult models verbalizing the cognitive operations they use in arithmetic problem-solving activities. These results were purported as lending support to the idea that children’s self-efficacy beliefs have an important effect on their academic performance attainments.

A later study by Schunk (1982) sought to test the strength of effort attributional feedback (i.e. “You have been working hard”) concerning past accomplishments in promoting perceptions of self-efficacy beliefs and subtraction skill development among previously identified low-achieving middle grade students. The participating students were divided into four different treatment groups: Past attribution, future attribution, monitoring, and training control. All students were given a training packet on subtraction skills which included instructions for and examples of the general type of subtraction problems that they were asked to work independently. Three of the groups were monitored by proctors every 8 minutes in the form of inquiring about the number of pages students had completed at that time. In the past attribution group, proctors remarked, “You have been working hard” in response to the students’ answer on the current page number in their work progression. Future attribution students were told, “You need to work hard.” The students involved in the monitoring only group did not receive any remarks from the proctors following their answer. Students in the training control group worked independently on the training packet without being monitored or interacting with proctors.
beyond the reading of the explanatory page. Schunk (1982) concluded that “attributional feedback linking past achievement with effort promotes task involvement, skill development, and perceived self-efficacy” (p. 553). The analysis of the data revealed evidence which supports the idea that students’ self-efficacy beliefs have a significant effect on their future performance attainments. Continuing his investigation of the influences attributional feedback has on self-efficacy and skill development, Schunk found that ability feedback (i.e. “You’re good at that”) had a more significant effect on perceptions of efficacy and subtraction skill improvement than effort attributional feedback (i.e. “You have been working hard”) or a combination of ability and effort attributional feedback (Schunk, 1983). Once again the evidence was interpreted as supporting the important relationship between self-efficacy beliefs and subsequent achievement.

However, Zimmerman, Bandura, and Martinez-Pons (1992) tested a conceptual model of self-regulated motivation and academic learning which hypothesized that students’ perceived self-regulatory efficacy would influence their perceived academic achievement efficacy which in turn would influence their personal goals and grade achievement. This model was found to be a statistically adequate fit for the obtained data with efficacy expectations for academic achievement and students’ grade goals providing 31% of the variance in the students’ academic course attainment. These authors concluded that academic self-efficacy influenced achievement directly and indirectly through students’ grade goals. An interesting finding from this study included a non-significant direct relationship between the past year’s social studies grades and the present semester’s social studies grades. Prior achievement was shown to have correlated with student academic efficacy beliefs and goal setting though mediated by parents’ academic goals for their children. A study that supports this finding of the mediation of past experience by efficacy beliefs, Pajares and Miller (1994), in a mathematics-oriented investigation, uncovered
that self-efficacy had a more significant direct effect on mathematics problem-solving than did self-concept, perceived usefulness, or prior experience.

Continuing the research on mathematics, Pajares and Kranzler (1994, 1995a, 1995b), used path analysis to test the influence of mathematics efficacy beliefs and general mental ability on math problem-solving performance. The constructed path model included math self-efficacy, general mental ability (i.e., assessed by a nonverbal test of general reasoning ability), math anxiety, mathematics level placement (i.e., highest high school mathematics course taken at time of study), and gender. While purposely controlling the general ability variable, these authors still found evidence suggesting that mathematics efficacious beliefs had strong direct effects on math anxiety and math problem-solving performance. Additionally, in concurrence with other findings (see Pajares, & Miller, 1994; Zimmerman, Bandura, & Martinez-Pons, 1992) self-efficacy beliefs were found to mediate the effect of ability and math experience both on anxiety and performance scores.

These studies related to student academic performance and achievement have established self-efficacy beliefs as a “powerful motivation construct that works well to predict [student] academic self beliefs and performances at varying levels” (Pajares, 1996, p. 557). Findings from cognitive performance and achievement research in the educational community has recognized that students’ self-efficacy beliefs are an important factor in determining their academic motivation, learning, and achievement (Pajares & Schunk, 2005).

Summary

Within these studies investigating efficacy beliefs and their influential impact, the following observations can be argued: (a) highly efficacious people are more certain of their career choices and more persistent and successful in accomplishing their career goals, (b)
efficacious teachers have the confidence to design and implement learning environments that provide students of differing abilities the opportunities for success, and (c) students through their positive self-efficacy beliefs are better able to increase skill levels and develop the academic goals that leads to higher academic achievement. The information gleaned from these studies places a specific emphasis on the importance of self-efficacy beliefs within the educational sphere. One of the purposes of this study is to highlight the importance of these self-evaluating beliefs that have been demonstrated as a vital key to student success.

Although the majority of self-efficacy studies conducted in academic settings have focused on their predictive value toward student outcomes or motivation constructs, Pajares (1996) has recommended that more investigative focus is needed on the sources of efficacy information. As we have already seen through the studies of Schunk (1981, 1982, 1983), self-efficacy beliefs are influenced by various forms of feedback (i.e., effort attributional and ability) and modeling. Bandura (1997) would categorize these types of feedback and the cognitive modeling as two of the four hypothesized sources of information from which people form their efficacious beliefs. The following section provides a more in depth look at these forms of information termed the sources of self-efficacy.

Sources of Self-Efficacy

Bandura’s (1977) early research hypothesizes that self-efficacy beliefs are constructed from four principal sources of information: 1) performance accomplishment, such as adding fractions successfully, perfecting an athletic skill, or overcoming a phobia, 2) vicarious experience, such as observing peers successfully working math problems, recalling successful experiences with similar endeavors, or having a more competent person demonstrate the basic moves of a dance, 3) verbal persuasions, such as positive teacher feedback, peers’ encouraging
comments, or trusted others attributing success to effort and progressing ability, and 4) emotional-physiological states, such as anxiety, fatigue, mood, stress, and arousal. Each of these conceptual sources is symbiotic. That is, most students will not master all the skills and confidence necessary for factoring trinomials without someone modeling the correct procedure, encouraging their efforts at factoring, experiencing some emotional reaction to failure, and then after attaining the skill successfully readjusting the perception of their abilities.

Performance Accomplishments Source
A student’s interpretation of their performance accomplishments has been identified as the most influential source of self-efficacy beliefs (Bandura, 1997). In practical terms, performance accomplishments develop from the student’s perception formed by the pattern of success or failure of their previous performance attempts of that task or a similarly related task. Research studies attempting to explore this conceptual source have shown that performance accomplishment exerts more influence over self-efficacy beliefs than even objective assessments, such as college mathematics course grades (Lane, 2002; Lopez, Lent, Brown, & Gore, 1997). Even more specifically, Zimmerman, Bandura, and Martinez-Pons (1992) concluded that academic self-efficacy influenced achievement directly and indirectly through students’ grade goals. An illustration would be to imagine two different students with opposing grade expectations (i.e. one is confident of success and the other is doubtful) receiving the same grade of 80 on a test. The student with high grade expectations might judge this grade of 80 as adversely affecting their efficacy confidence, while the student with low grade expectations might judge the same grade of 80 as boosting their efficacy confidence. It is the student’s interpretation of the performance assessment that is the basis of that student’s self-efficacy belief formation (Usher & Pajares, 2006).
**Vicarious Experience Source**

While performance accomplishment refers to the interpretation of a student’s own actions, vicarious experience refers to the observation of the actions of others (Usher & Pajares, 2006). When students similarly identify with those others that are successfully performing challenging tasks, then this can have a positive influence on their own efficacy beliefs (Bandura, 1986, 1997; Schunk, 1987). Alternately, the observation of similarly able peers struggling with challenging tasks can have an equally negative effect on the efficacious beliefs of the observer (Bandura, 1997). Vicarious experience has the most impact on those that are inexperienced with the modeled task or those students who are not confident of their ability with that task (Bandura, 1986; Pajares, 1997). Eccles, Midgley, and Adler (1984) suggested that vicarious experiences may increase in self-efficacy influential strength during students’ transitional periods.

**Verbal Persuasion Source**

Self-efficacy beliefs depend on a student’s ability to evaluate their performances. Those students who have difficulty with this evaluation will depend on others to provide these assessments. Another source influencing an individual’s self-efficacy beliefs is termed verbal persuasion (Bandura, 1977). Positive evaluations from trusted others (i.e. parents, teachers, and peers) can increase a student’s confidence in their academic ability, but this increased confidence has rarely proven to be permanent. Specifically, students are inclined to trust the evaluations of their mathematical abilities from the people they deem to be skilled in those activities or expert in mastering those activities (Bandura, 1997). Presently, measurement instruments disregard students’ trust of the individual(s) responsible for those mathematical ability evaluations. Measures of verbal persuasion that neglect this factor do not provide a complete picture of its true influential nature (Usher & Pajares, 2008).
Negative evaluative persuasions can severely inhibit a student’s confidence in academic ability. For instance, Bandura (1986) maintains that lowering self-efficacy beliefs through negative evaluations has longer lasting effects than enhancing those beliefs through positive verbal persuasions. Several research studies suggest that verbal positive and/or negative evaluations, particularly those received from teachers, are more important to some students (i.e. females and minorities) than previously believed (Klassen, 2004; Usher & Pajares, 2006; Zeldin & Pajares, 2000).

*Emotional-Physiological States Source*

The fourth conceptual source hypothesized to inform and/or transform self-efficacy beliefs are the emotional-physiological states that serve as competence indicators such as observable states of anxiety, stress, mood, fatigue, and arousal. Pajares (2002) explains that:

People can gauge their degree of confidence by the emotional state they experience as they contemplate an action. Strong emotional reactions to a task provide cues about the anticipated success or failure of the outcome. When they experience negative thoughts and fears about their capabilities, those affective reactions can themselves lower self-efficacy perceptions and trigger additional stress and agitation that help ensure the inadequate performance they fear. (p. 7)

Bandura (1997) suggested that when emotional-physiological states are interpreted as challenging experiences, then self-efficacy beliefs could be positively influenced. Usher and Pajares (2008) remarked that a positive mood accompanied by academic success could provide increases in personal efficacy beliefs. Unfortunately, the positive dimensions of emotional physiological states have not yet been adequately assessed by quantitative measures (Usher & Pajares, 2008).
Strong emotional reactions and anxiety toward specific academic tasks contribute to students’ efficacy belief formation which is utilized to determine their academic capabilities (Usher & Pajares, 2006). For this reason, attending to students’ physical and emotional well-being is important when seeking to strengthen students’ self-efficacy beliefs. Many research projects have attempted to verify the strength of influence of the four proposed sources of self-efficacy beliefs.

**Divergent Research Evidence of the Influential Nature of Efficacy Sources**

Numerous researchers (Anderson & Betz, 2001; Klassen, 2004; Lent, Lopez, & Bieschke, 1991; Lent, Lopez, Brown, & Gore, 1996; Lopez et al., 1997) have found correlations between all four hypothesized sources of self-efficacy though not all studies have shown consistent results. In a sample of 50 high school Algebra II students, Lopez and Lent (1992) found that performance accomplishments were the most influential source of mathematics self-efficacy. Additionally, results from this study found that emotional-physiological states added significantly to the prediction of students’ efficacy beliefs. Vicarious experiences and verbal persuasions were not found to have any significant efficacy influence, even though in a study of 163 freshman undergraduates in Japan, Matsui, Matsui, and Ohnishi (1990) found that three of the four sources showed a significant relationship to the formation of self-efficacy beliefs. This step-wise regression analysis recognized performance accomplishment, vicarious experience, and students’ lack of anxiety (i.e. emotional-physiological state) to have uniquely contributed to the undergraduates’ efficacy beliefs. These authors suggested that a high correlation between performance accomplishments and verbal persuasions may have nullified its unique contribution to the strengthening of self-efficacy beliefs. Another comment of interest was that all of these “[s]ubjects had passed the highly selective university entrance exam, including mathematics” (p.
This may account for the differences in significant findings for the sources of self-efficacy belief formation (Matsui, Matsui, & Ohnishi, 1990).

Bandura (1997) emphasized that the strength of the conceptual source’s influence is contingent on the student’s interpretation of the efficacy information produced by the source. A number of educators have attempted to verify this by investigating the relationship between the origins of efficacy belief formation and different classifications of students (i.e. gender, academic status, and racial/ethnic identifications). For example, Hampton and Mason (2003), using a structural equation model on 278 high school students, examined the impact of gender, learning disability (LD) status, and the sources of self-efficacy on efficacy formation and academic achievement. Among the results obtained from this study, all four sources of efficacy were found to be significantly related to students’ self-efficacy beliefs, which in turn were found to be the influential mediator of academic achievement. The evidence appeared to indicate that the students with more access to the sources of self-efficacy were the students with the highest levels of self-efficacy beliefs and academic performance. Results indicated that LD students’ efficacy beliefs were affected indirectly by lack of access to the sources of self-efficacy. These authors postulated that LD students reported lower efficacy levels could be explained by their limited access to the four sources of efficacy formation (Hampton & Mason, 2003).

Klassen’s (2004) study of 270 seventh-grade South Asian (Indo Canadian) immigrant and Anglo Canadian nonimmigrant students is one of the few studies focusing on the self-efficacy sources that examine possible differences between two ethnic/minority groups. The study surmised that there were little differences between groups when it pertained to the influence of self-efficacy beliefs toward academic performance. However, there were differences in the persuasive informational factors that influenced the formation of their self-efficacy beliefs. The
Indo Canadian students reported that their self-efficacy beliefs were more strongly influenced by vicarious experiences and verbal persuasions than did the Anglo Canadian students. This could be due to the suggestion that “self-efficacy is influenced by different sources of information that are more or less persuasive depending on a person’s cultural values” (Earley, 1994, p. 114). Students from minority cultural backgrounds are not the only group to name sources other than performance accomplishments as a significant influence toward the formation of their self-efficacy beliefs.

In a study of 263 sixth grade students from a Southeastern suburban middle school, Usher and Pajares (2006) set out to explore the influence of the sources of self-efficacy on the academic and self-regulatory efficacy beliefs and whether or not these sources differ as a function of gender, reading ability, and race/ethnicity. In sync with much of the previous research in this area, this study also found that each of the sources contributed to the formation of self-efficacy beliefs with perceived performance accomplishments explaining the largest proportion of the variance. Usher and Pajares (2006) remarked that while past research findings have indicated performance accomplishments as the most influential source for self-efficacy beliefs, their study found that White females and African American students interpreted verbal persuasions as a highly influential source of their self-efficacy beliefs. In both of these groups, verbal persuasions accounted for greater unique variance than did performance accomplishments. The low-ability (i.e. assessed by reading ability) students in this same study attributed their emotional-physiological states as a predictive factor in the formation of their self-efficacy beliefs (Usher & Pajares, 2006). Usher and Pajares further noted there has been very little research on how verbal persuasions influence self-efficacy beliefs. Although these findings are somewhat surprising, they are not unique due to an earlier study that found corroborating evidence.
Zeldin and Pajares (2000) conducted a qualitative study of fifteen highly successful career women in the mathematical, scientific and technological fields. The analysis of these interviews revealed that vicarious experiences and verbal persuasions are considered by these participants as compelling efficacy formation resources. The authors concluded that the women of this study relied not only on their own capability perception, but also on the information provided by others. The complementary nature of the findings between this qualitative inquiry with their own quantitative analyses propelled Usher and Pajares (2006) to recommend that it would “be valuable to discover how students select, attend to, and recall the persuaders who exercise the deepest formative influence on them” (p. 139, italics added).

Summary

From these studies focused on the informational sources that are proposed to incrementally affect self-efficacy beliefs, the following conclusions are presented: (a) performance accomplishments are considered by many to be the strongest source of efficacy influence, (b) gender and cultural/ethnic background may affect the types of information that is weighted and internalized for the reassessment of efficacy beliefs, and (c) students with learning disabilities or difficulties are potentially being excluded from the informational sources that are necessary to positively affect their self-efficacy belief formation. Evidence was presented that validates a more thorough investigation of all types of information that students may utilize in the assessment, formation, and readjustment of their mathematics self-efficacy beliefs.

Of the four sources of self-efficacy proposed by Bandura (1977), social persuasions and emotional arousal are the two sources most closely associated with the teacher-student relationship. Verbal persuasions are only as effective as the degree to which the student values or trusts the opinion of the ‘persuader’ (Usher and Pajares, 2006). Additionally, when students feel
comfortable and safe within their environments, destructive physiological reactions to difficult tasks are kept to a minimum. The successes and failures of tasks, concepts modeled, encouragements and admonishments spoken, and anxieties acknowledged and ignored, respectively represent the four sources of self-efficacy beliefs of which all occur within the classroom learning environment.

Learning Environment

The body of classroom learning environment research has commonly made use of the following self-report instruments: Learning Environment Inventory (LEI: Fraser, Anderson, & Walberg, 1982), Classroom Environment Scale (CES: Moos & Trickett, 1987), My Class Inventory (MCI: Fraser, Anderson, & Walberg, 1982), and Individualized Classroom Environment Questionnaire (ICEQ: Fraser, 1990). A stockpile of rich data on teachers’ and students’ perceptions of the psychosocial learning environment has been provided by these original instruments or variations of these instruments (Lorsbach & Jinks, 1999). All of these scales were developed along Moos’s (1974) scheme for classifying human environments:

Moos’s three basic types of dimension are Relationship Dimensions (which identify the nature and intensity of personal relationships within the environment and assess the extent to which people are involved in the environment and support and help each other), Personal Development Dimensions (which assess basic directions along which personal growth and self-enhancement tend to occur), and System Maintenance and System Change Dimensions (which involve the extent to which the environment is orderly, clear in expectations, maintains control, and is responsive to change). (Fraser & Fisher, 1994, p. 24)
Historically, studies have investigated students’ perceptions of the learning environment (i.e. classroom environment) and their relationship to student outcomes (Fraser & Walberg, 2005). These studies have shown significant relationships between the nature of the classroom environment and various student cognitive and affective outcomes (Fraser, 1986; Fraser & Fisher, 1982; Haertel, Walberg, & Haertel, 1981). Fraser and Fisher (1983) affirmed through their research that student achievement and attitudes are enhanced when there is a similarity between the actual classroom environment experience and the student preferred classroom environment.

Lorsbach and Jinks (1999) set the stage for the study of learning environments and self-efficacy beliefs by suggesting the strong connection between these two formerly separate research constructs. These authors used Moos’s (1974) three major dimensions for classifying the human environment to demonstrate the association between classroom environment (i.e. learning environment) and self-efficacy beliefs. In their argument, self-efficacy is important to the Relationship Dimension because it is dependent on personal relationships. In other words, the perception of one’s own ability is partially accomplished through a comparison with peers and by significant others (i.e. parents, teachers). Self-efficacy can be described as a self-appraisal of ability which possibly leads to increases in student outcomes. This explains the connection to the Personal Development Dimensions. The ways in which goals, incentives, and expectations are created and maintained in the classroom are concepts that are identified with System Maintenance and System Change Dimensions. Accurate appraisals of ability (i.e. self-efficacy beliefs) are also dependent on the order and clarity of purpose within the classroom environment (Lorsbach & Jinks, 1999). The amount of learning environment research that has concentrated on the associations between students’ perceptions of classroom environments and their self-efficacy
beliefs has been limited. Dorman (2001) sought to remedy this disparity with a study involving 1055 secondary mathematics students from nine different Australian high schools. These students responded to an instrument that contained ten different dimensions from two original questionnaires (i.e., What Is Happening In This Classroom? (WIHIC) (Aldridge & Fraser, 2000; Fraser, 1998b) and the Constructivist Learning Environment Survey (CLES) (Fraser, 1998b; Taylor, Fraser, & Fisher, 1997). The most important finding from this inquiry was recognized as a significant association between classroom environment and academic efficacy (Dorman, 2001). The author recommended that “[i]t would be desirable if academic efficacy theory embraced the advances made by learning environment researchers and recognized the importance of classroom context in understanding academic efficacy” (p. 254). The argument of a relationship between all the factors within the learning environment and self-efficacy beliefs is much stronger than the argument whether any one factor, such as the teacher-student relationship (i.e. teacher classroom interpersonal behavior), has a unique contribution toward students’ self-efficacy beliefs.

Teacher-Student Relationship

Teacher support has been recognized as one of the influential factors identified as affecting student motivation and achievement (Garmezy, 1994; Pianta, 1999; Viau, 1994). In particular, a longitudinal study was conducted on 1301 students and their respective mathematics teachers before and after they transitioned to junior high school. This study found sufficient evidence to state that this transition is most detrimental to low achieving students who perceive their new teacher as less supportive. Feldlaufer, Midgley, and Eccles (1988) cautioned that when students perceive the new teacher as less supportive than their elementary teacher, a sharp decline in intrinsic value, perceived usefulness and importance of mathematics is possible. Supporting these findings, Wentzel’s (1998) study of 167 sixth graders concluded that the
amount of teacher support perceived by middle school students was directly linked to their interest in academic subjects. This was not surprising when considering that in a 3-year study of 375 middle school students, Wentzel (1997) found significant evidence that the students’ perceptions of teacher caring predicted their academic effort. The characteristics of a ‘caring teacher’ have been closely related to the proximity axe of the two-dimensional (2-D) Model for Interpersonal Teacher Behavior (MITB; Wubbels, Créton, & Hooymayers, 1985; Wubbels & Levy, 1993).

Teacher Classroom Interpersonal Behaviors

Wubbels and Levy (1993) initiated an important research into the quality of interpersonal interactions between teachers and students. Their research was inspired by the systems approach to communication theory of Watzlawick, Beavin, and Jackson (1967) and Leary’s (1957) research on the interpersonal diagnosis of personality. In the systems approach, it is assumed that it is impossible not to communicate when you are with another person, regardless of your original intention (Wubbles & Brekelmans, 2005). This unintentional communication makes students’ perceptions of the interaction within the classroom worthy of educational investigation. Leary’s model, which allowed the graphical representation of interpersonal behaviors along two dimensions (i.e., influence and proximity), uses the influence dimension to measure the degree of control over the communication process and the proximity dimension to measure the degree of cooperation felt by those involved in the communication process (Goh and Fraser, 2000).

Leary’s (1957) work provided the basis for the Model of Interpersonal Teacher Behavior (MITB) (Wubbels, Créton, & Hooymayers, 1985; Wubbels & Levy, 1993) which is comprised of two dimensions: Influence (Dominance—Submission) and Proximity (Opposition—Cooperation). These dimensions underlie eight types of behavior: leading,
helpful/friendly, understanding, student responsibility and freedom, uncertain, dissatisfied, admonishing and strict (Wubbels & Brekelmans, 2005) (See Figure 1). The instrument that was designed to operationalize the MITB, the Questionnaire on Teacher Interaction (QTI) (Wubbels, Créton, & Hooymayers, 1985), uses the two-dimensional Leary model and the eight types of behavior to map teacher-student relationships. Research utilizing the QTI has identified relationships between teacher classroom interpersonal behaviors and students’ cognitive and affective outcomes.

Brekelmans’ (1989) study of a high school Physics class revealed that a direct variation occurred between students’ Physics test scores and their ratings of the teacher on the Influence dimension. The students that perceived their teachers to be high in Influence had the highest scores on the Physics test. Other studies also found positive correlations to cognitive outcomes and the Influence dimension scale (Goh & Fraser, 2000; Henderson, 1995). This positive correlation has also been found within the Proximity dimension for a variety of scales (i.e. helpful/friendly, understanding, and responsibility/freedom) (Evans, 1998; Goh & Fraser, 2000; Henderson, 1995). The studies that showed positive correlations between teacher classroom interpersonal behaviors and the Proximity dimension were not always directly linear. These studies revealed that low perceptions of proximity mapped low cognitive outcomes, but the higher perceptions of proximity only related to higher outcomes up to a certain optimal point (den Brok, 2001; den Brok, Brekelmans, & Wubbels, 2004).

The strongest relationships found between teacher classroom interpersonal behaviors and student outcomes fall within the affective domain. Most research investigations concentrating on the affective domain have revealed positive relationships within both the Influence and Proximity dimensions (Wubbels & Brekelmans, 2005). Brekelmans’ (1989) study reported
strong evidence of the relationship between the Proximity dimension and student motivation for Physics. Other subject-specific motivation studies have demonstrated positive relationships which link the scales of helpful/friendly and understanding to the pleasure, effort, and relevance a student has for that subject (Derksen, 1994; Setz, Bergen, van Amelsvoort, & Lamberigts, 1993; van Amelsvoort, 1999). In a study of middle school students, Lapointe (1998) stated that students who perceived high cooperation and low opposition from their teachers reported a higher level of learning engagement within the classroom.

Den Brok, Levy, Brekelmans, and Wubbels (2005) used multilevel analysis to recognize the hierarchical nature of the data to include covariates such as student, class, or teacher characteristics, and to allow the additional variables, such as prior motivation and achievement, in order to determine whether teacher interpersonal behavior produced an unique effect on subject-specific motivation. The purpose of this study was to investigate the relationship between English as a Foreign Language (EFL) teachers’ classroom interpersonal behavior and students’ motivation. The population of this study included 52 third-year classes totaling 1041 secondary students in the Netherlands. In this study, all discerned subject-related attitude variables—pleasure, confidence, effort, and relevance—were tested for their association with teacher interpersonal behavior. The results revealed that a strong and positive effect was found for teacher Proximity to all four of the subject-related attitude variables. Three of these variables—pleasure, relevance, and effort—also showed a positive effect for teacher Influence. These authors had two important recommendations as a result of this inquiry: the recognition of the importance of teacher classroom interpersonal behavior to student motivation attitudes and indirectly student cognitive outcomes, and the use of student perceptions of teacher interpersonal behavior in future research projects.
Lapointe, Legault, and Batiste (2005) claim to have conducted one of the first studies examining the role perceptions of teacher interpersonal behavior have in students’ motivational beliefs (i.e. self-efficacy, intrinsic value and test anxiety in mathematics) within three different schooling tracks. This study was conducted in two different Quebec City schools on 111 learning disabled (LD), 224 average (AV), and 258 talented (TA) students in the seventh and eighth grades. The Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich & DeGroot, 1990) and the Questionnaire on Teacher Interaction (QTI) (Wubbels & Levy, 1993) were the instruments used to address three objectives of this inquiry: 1) compare students’ motivational beliefs in mathematics, 2) compare students’ perceptions of their math teacher’s interpersonal behavior, and 3) examine the links between interpersonal behavior and motivational beliefs. The results revealed that AV and LD students’ self-efficacy and intrinsic value beliefs, which were lower than TA students, remained stable from pre- to post-testing. LD students had higher levels of test anxiety in the fall and spring while AV students’ test anxiety was higher than TA students in the fall. TA students showed a decline in self-efficacy beliefs and an increase in test anxiety over the course of the school year. The only differences among groups in the students’ perceptions of their math teacher’s interpersonal behavior were that LD students felt their teachers (LD students are educated separately in low-ability classes) were more admonishing and AV students perceived their teachers to be less strict than did TA or LD students. Teacher Proximity was linked to all three motivation variables for AV and TA students. It lessened the decline of these students’ motivation and stunted the increase of test anxiety over the school year. LD students’ results did not show any relationship between motivational variables and teacher classroom interpersonal behavior. Lapointe, LeGault, and Batiste (2005) concluded that “perceptions of teacher behavior play a significant role in average and talented young
adolescents’ self-efficacy, intrinsic value, and test anxiety in math” (p. 51). Although most of the studies investigating the teacher classroom interpersonal behavior have occurred within the secondary classroom, there have been a few studies that have concentrated on the impact within elementary classrooms.

One such study which focused on the perceptions of elementary-aged students, Goh and Fraser’s (1998) is particularly important because it marks the first validated adaptation of the QTI to measure elementary-aged children’s perceptions. The study used a random sample of 1512 boys and girls from 39 different mathematics classes within 13 government primary schools in Singapore. The focus of this study was to examine teacher classroom behavior and classroom climate and their possible relations with affective and cognitive outcomes. In addition to the adapted QTI, they utilized a modified version of the My Class Inventory (MCI; Fisher & Fraser, 1981; Fraser & O’Brien, 1985), and two self-designed instruments called Liking Mathematics Scale and Mathematics Exercise. These three instruments were used to assess classroom climate, affective outcomes, and cognitive outcomes, respectively. Goh and Fraser (1998) concluded that “[i]nterpersonal teacher behavior and classroom climate each made a sizeable unique contribution to the variance in student attitudes but not student achievement…” (p. 222). They not only recommended that both the QTI and MCI be included in future research of student attitudes, but also recommended that a combination of quantitative and qualitative methods be utilized in future studies of this nature.
Summary

From the studies concentrating on the influential nature of students’ perception of teacher interpersonal behavior, the following evidentiary conclusions were discussed: (a) students’ perceptions of teacher support were strongly linked to students’ intrinsic value of mathematics, their academic interest and effort, (b) while there is evidence of a connection between the teacher classroom interpersonal behavior and cognitive outcomes, the non-linear correlations perhaps suggest a mediating factor, (c) there is strong evidence suggesting that teacher interpersonal behavior is a powerful influence toward students’ subject-specific motivation, learning engagement, and general mathematics attitudes, and (d) the lack of relationship between the attitudes of learning disabled students and their perceptions of teacher interpersonal behavior suggests the importance of continued investigative focus on this line of inquiry.

Chapter 2 Summary

A large part of the learning environment is comprised of the personal and interpersonal interactions between teachers and students (Arowosafe & Irvin, 1992; Ferguson & Fraser, 1998; Rickards, 1998). These “relationships,” while only lasting a year, seem to have positive and negative lasting effects on students’ perceptions of learning and teaching. Research over the past 25 years has shown that teacher interpersonal behavior is a strong influence over student achievement and motivation in all subject areas (Brekelmans, Wubbels, & den Brok, 2002; den Brok, 2001; Wubbels & Brekelmans, 1998; Fraser, 1998b). Research on self-efficacy beliefs has shown itself to be a worthy area of concentration within the classroom. It was the intent of this study to seek the connection, if any, between the teacher classroom interpersonal behaviors and students’ mathematics self-efficacy beliefs.
There are three connecting points that provided substantiation to the focus of this study: (a) the teacher classroom interpersonal behaviors have been credited with influential effect on intrinsic value of mathematics, students’ academic interest and effort, subject-specific motivation, and general mathematics attitudes (i.e. self-efficacy and test anxiety), (b) the two self-efficacy belief informational sources most closely tied to teacher interpersonal behavior (i.e., verbal persuasion and vicarious experience) have been shown as possibly holding a more influential position in affecting the self-efficacy beliefs of females and minority students, and (c) learning disabled students’ low efficacy beliefs have been attributed to the lack of exposure to the sources of self-efficacy which, in turn, may explain the lack of influence LD students reported about teacher classroom interpersonal behaviors. Mathematics educators have been searching for the clues to explain students’ disassociation with mathematics and mathematics-related careers. The contention is that the relationship between teacher interpersonal behavior and its influence over students’ mathematics efficacy beliefs could be a significant contributing factor to that disassociation. Since it has been the goal of mathematics education for quite some time to assure the mathematical proficiency of all students, this study proposes to concentrate its investigative focus on all students rather than on sub-groups of the general population.

Chapter 3 discusses the methodology of the study, which includes identifying the participants of the study, and the data collection. In addition, the following chapter will identify the instruments that were used for the quantitative portion along with the means of collecting all qualitative data and the proposed analysis for both types of data.
CHAPTER 3

METHODOLOGY

Introduction

This chapter presents the participants, the researcher’s background, the data sources protocol, the data collections, and the data analysis. This mixed-method study investigated the teacher classroom interpersonal behavior and the relationship to students’ mathematical self-efficacy beliefs. The questions that investigated these relationships are:

1.) What changes, if any, occur in ninth and tenth grade students’ pre-and post perceptions of Bandura’s four sources of mathematics self-efficacy?

2.) What changes, if any, occur in ninth and tenth grade students’ perceptions of the teachers’ interpersonal classroom behaviors?

3.) How do the changes in perceptions affect the relationships that may exist among ninth and tenth grade students’ perceptions of their mathematics self-efficacy beliefs, the sources of those beliefs, and their teachers’ interpersonal classroom behaviors?

4.) How are Bandura’s four sources of self-efficacy addressed during one ninth grade’s Algebra I classroom instruction?

Participants

The participants in this study were enrolled in a 4A high school in a rural Southwest Alabama county. All students were given a consent form, along with parent or guardian assent forms (see Appendix A). Out of the 294 ninth and tenth grade students, 125 students responded.
Analysis of survey instruments at the end of the study resulted in the elimination of 28 participants. The following factors were responsible for the elimination of study participants: a) pre-administration only; b) patterning of answers; and c) incomplete survey data. After survey analysis was completed, there were 97 participants in total. The population of this study included 97 ninth and tenth grade mathematics students from five courses taught in 15 different classes by five mathematics teachers, including the researcher. The five courses include Algebra I, Algebra IA, Algebra IB, Algebra II, and Geometry. Algebra IA and Algebra IB, taught to ninth and tenth grade students, is the equivalent of Algebra I. This fact preaced the decision to include ninth and tenth grade students as participants of this study. Sixty of the 97 were enrolled in five of the researcher’s mathematics classes. A representative class, selected from analysis of students’ perception data, is one of the five researcher’s mathematics classes. The representative class consisted of 20 from the 32 enrolled students who elected to participate in phase two and three. The population of 97 students was labeled as “All” (i.e. participants); the 60 students were labeled as “AW students”; and the 20 students were labeled as “Representative” (i.e. students). Table 2 provides the percentages of race and sex by research group.

Table 2

Demographic Percentages by Group

<table>
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<tr>
<th>Quantitative</th>
<th>Research Group</th>
<th>N=</th>
<th>White</th>
<th>African-American</th>
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<td></td>
<td></td>
<td></td>
<td>Male</td>
<td>Female</td>
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<tr>
<td></td>
<td>All</td>
<td>97</td>
<td>5%</td>
<td>11%</td>
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<tr>
<td></td>
<td>AW students</td>
<td>60</td>
<td>7%</td>
<td>12%</td>
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<tr>
<td></td>
<td>Representative</td>
<td>20</td>
<td>15%</td>
<td>15%</td>
</tr>
</tbody>
</table>
The rural county has approximately 24,000 people and is ranked 43 out of 51 Alabama county populations. Most of the county is rural, with approximately 29% urban. The town where the high school is located has approximately 6,900 residents. Manufacturing plants employ approximately 34% of county residents. Less than 10% of the county’s population has a four-year degree; less than 5% earned a graduate degree.

Approximately seventy-three percent of the children in the county attend public schools. This public high school, fully accredited by the Southern Association of Colleges and Schools, is the largest in the county with an enrollment of approximately 590 students. The ethnic composition is approximately 69% African-American, 30% White, and less than .05% Asian. This school qualifies for Title I federal assistance with 65% of students eligible for free or reduced lunch.

Researcher’s Personal Background

My college career was an on-and-off again affair. I was 30 years old when I completed my undergraduate degree. At that time, I discovered that it was my belief in my mathematical ability, or my mathematical self-efficacy, that was largely responsible for my persistence in obtaining my degree in secondary mathematics education. Now I am convinced that my mathematics self-efficacy contributed to my pursuit and persistence at obtaining my doctorate of education in secondary mathematics.

At present, I am a 49 year old white female secondary mathematics teacher born and raised in rural south Alabama. I attended a small elementary-high school campus with approximately 500 students from the 1960’s to the 1970’s. Administrators and teachers emphasized structure and discipline, where discipline was maintained strictly through corporal punishment. The school’s academic structure was a long held tradition of very quiet students
whom rarely were encouraged to ask questions or to develop any kind of teacher-student relationship beyond that of a transmitter and receiver.

Students’ academic tracks were determined either by their parents’ wishes or previous achievement records. Students who lacked success in their academic track were discouraged from pursuing advanced diplomas or pursuing college degrees. As a successful student, I was not conscious of the ‘down side’ that less successful students experienced from the structure and discipline that shaped all the students from my school.

At the beginning of my career, I still practiced as I had learned; memorization of mathematical facts was essential to the learning of mathematics. It was evident my classroom management style reflected my personal schooling of structure and discipline experiences. As my classroom teaching progressed, I realized that I continued to establish within my classroom the same discipline and structure. This organized structure and discipline insight promoted the same effects I had experienced, namely, silencing many of my students in learning mathematics.

I blamed my students for their lack of attention and memorization skills until I realized my teaching philosophy was doomed to fail. Thankfully, I began my masters’ program about the same time as this insight. The program’s influence of pedagogical training and required teaching self-reflection shifted the locus of ‘blame.’ This marked the beginning of my interest in knowing more about my teaching style and its effect on my students. That interest compelled me to continue to seek answers to the questions that had emerged about my teaching practices. That journey led me to seek and complete my Education Specialist degree (Ed.S.) in secondary mathematics. Many of the Ed.S. courses prompted informal outside of class peer discussions. Many of those discussions centered on our teacher-student relationships. The academic environment of the courses seemed to bring this relationship to our consciousness. Conclusions
from these discussions were that effective teaching required this relationship. These colleague interactions developed an interest in researching an oft-overlooked area in secondary classrooms. I’ve come to believe that students’ perceptions of teacher classroom interpersonal behavior play a role in the formation of their academic self-beliefs.

Use of Mixed Method Procedure

In 2004, Johnson and Onwuegbuzie defined mixed methods research “as the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts, or language into a single study” (p. 17). The authors suggested two major types of mixed method research designs: mixed model and mixed method. Mixed model is defined as the “mixing qualitative and quantitative approaches within or across the stages of the research process” and mixed method is described as “the inclusion of a quantitative phase and a qualitative phase in an overall research study” (Johnson & Onwuegbuzie, 2004, p. 20). The construction of a mixed method research design requires the researcher to make two primary decisions. First, deciding whether one paradigm will be dominant other the other. Second, deciding whether the phases should be conducted concurrently or sequentially.

Weiss (1998) stated that “some evaluation theorists, notably Guba and Lincoln (1989), hold that it is impossible to combine qualitative and quantitative approaches responsibly within an evaluation” (p. 268). In response to Weiss’s interpretation, Guba and Lincoln (2005) responded that,

We have argued that at the paradigmatic, or philosophical level, commensurability between positivist and postpositivist worldviews is not possible, but that within each paradigm, mixed methodologies (strategies) may make perfectly good sense (Guba & Lincoln, 1981, 1982, 1989, 1994; Lincoln & Guba, 1985)…. As we tried to make clear, the ‘argument’ arising in the social sciences was not about method, although many critics of the new naturalistic, ethnographic, phenomenological, and/or case study approaches assumed it was. (p. 200)
Onwuegbuzie and Leech (2004) postulate that greater confidence can be achieved for the findings from studies that are corroborated across different methodological approaches. These authors contend that when findings are not corroborated, then the conflict in the findings provides the researcher with greater knowledge that helps her to modify interpretations and conclusions accordingly. They challenge that corroboration is not always the main reason for mixing methods, but instead to expand the understanding one has of a social phenomenon.

In 2007, Johnson, Onwuegbuzie, and Turner constructed a new definition of mixed methods research as follows:

Mixed methods research is an intellectual and practical synthesis based on qualitative and quantitative research; it is the third methodological or research paradigm (along with qualitative and quantitative research). It recognizes the importance of traditional quantitative and qualitative research but also offers a powerful third paradigm choice that often will provide the most informative, complete, balanced, and useful research results. Mixed methods research is the research paradigm that (a) partners with the philosophy of pragmatism in one of its forms (left, right, middle); (b) follows the logic of mixed methods research (including the logic of the fundamental principle and other useful logics imported from qualitative or quantitative research that are helpful for producing defensible and usable research findings); (c) relies on qualitative and quantitative viewpoints, data collection, analysis, and inference techniques combined according to the logic of mixed methods research to address one’s question(s); and (d) is cognizant, appreciative, and inclusive of local and broader sociopolitical realities, resources and needs. (p. 129)

The decision to use a mixed method design for this study was based on two major factors: 1) notable authors of the teacher classroom interpersonal behavior research community (den Brok & Levy, 2005; Fraser, 1998a; Rickards, den Brok, & Fisher, 2005) calling for the use of qualitative methods in future research utilizing the QTI, and (2) the belief that a mixed methods research design will provide the most complete picture in this present study.
Practical Argument

The current practical argument model is based upon Aristotle’s practical syllogism model to describe the reasoning that justifies a particular action taken because of that reasoning.

Aristotle’s practical syllogism addressed three reasoning conditions: 1) a major premise that requires reasoning to respond to an action or a desire of what one wants or intends to do; 2) a minor premise that requires reasoning to respond to a belief of what is possible within that particular intention, and; 3), a conclusion required to intellectually make connections between the intentions and beliefs for the action (or intention to act) from the syllogism discussion.

Syllogism, in the Aristotelian view, is a reasoning which leads to a conclusion that is different yet necessitated by its premises (Thorton, 1982). The practical syllogism has been described as a representation of our perception of particular situations that we encounter through the ends or goals that we strive to actualize through practical reasoning. The practical action choices that are made from one context to the next are attributed to this discernment of situational particulars through those overall goals (Penlington, 2006). Orton (1998) portrays the practical syllogism as a mechanism that characterizes the interaction of the minor and major premises in rational action. As such, the causal process of practical reason can be reconstructed as a practical syllogism, a chain of statements whose conclusion is an action (Orton, 1998).

Green (1976) adapted this philosophical dialogical way of justifying an action to the field of classroom instruction. He contended that in order for teachers to be successful in their instruction they must begin by,

. . . identifying what is required to change the truth value of the premises of the practical argument in the mind of the child, or to complete or modify those
premises or to introduce an altogether new premise in to the practical argument in the mind of the child. (p. 252)

Referring to Aristotle’s model of critical thinking reasoning, as well as Green’s adaptation, Fenstermacher and Richardson (1993) developed a process for inquiry into teachers’ practical reasoning and classroom instruction actions by having teachers videotape their instruction to conduct a practical reasoning for particular actions caught on tape. Critiques were limited to questions about classroom actions from an individual knowledgeable in the syllogism model of reasoning and audio taped for later transcription of the practical argument interplay. Vásquez-Levy (1998), using Fenstermacher and Richardson’s model, defined this interplay as, “…a partner who has knowledge about practical arguments, practical teaching experience, and a willingness to serve teachers as a dialogue partner and resource” (p. 536). Boody, East, Fitzgerald, Heston, and Iverson (1998) describes the interplay as a two-phase process beginning with the elicitation of the teacher’s premises (reasons for classroom actions) and then evolving into a reconstruction phase where the premises are measured through normative dimensions (i.e., research, theory, and/or experience). The elicitation and reconstruction phases are not necessarily distinct from one another. The main focus of the elicitation is to clarify the premises of the teacher’s classroom actions. Through this identification of premises, the other’s role shifts to more pointed questioning seeking to ‘reconstruct’ these premises within normative dimensions. The teacher’s role at this time is to evaluate along with the other whether or not the identified premises can be aligned with those normative dimensions of interest.

The practical argument was uniquely suitable for this study in that it allowed for an in-depth reflective examination of mathematics instruction practices, illumination of teacher beliefs, and teacher classroom interpersonal behaviors. In this study, the premises of the teacher’s beliefs
were analyzed through the teacher interpersonal classroom behavior and sources of self-efficacy dimensions.

Data Sources

*Questionnaire on Teacher Interactions*

Wubbels, Creton, and Hooymayers (1985) developed a *Model for Teacher Interpersonal Behavior* (MITB). The Wubbels et al. model was adapted from Leary’s (1957) research on interpersonal behavior used in clinical psychology and psycho-therapeutic settings. The Leary model postulated that interpersonal behavior and communicative style is determined by the personality of the individual. Leary’s clinical work provided strong evidence for his hypothesis that the two driving forces of human behavior are: (a) one’s desire to reduce fear, and (b) one’s desire to maintain self-esteem.

As with Leary’s model, Wubbels et al. adapted model mapped two dimensions of a teacher’s classroom interpersonal behavior: 1) Proximity continuum dimension points between the Cooperation labeled axis and Opposition axis, and 2) Influential continuum dimension points between the Dominance labeled axis and Submission axis. The axis labeled Proximity refers to the degree of closeness or cooperation between communicating parties. The axis labeled Influence refers to who is directing or controlling the communication. Those four continuum dimension points are placed along the two perpendicular lines that form a quadrant. Within each quadrant are two interconnecting sections for a total of eight sections: Leadership, Helpful/Friendly, Understanding, Student Responsibility/Freedom, Uncertain, Dissatisfied, Admonishing, and Strict behavior (See Figure 1).
Wubbels et al. original version of the QTI, first developed in the Netherlands, contained 77 item questions. Later, Wubbels and Levy (1991) designed an American version, containing 64 item questions. This study utilized the American version of the QTI.

The QTI, a reliable and valid instrument, has been used with much confidence on an international scale for over 20 years. The cross-cultural validity and usefulness of the QTI were confirmed in a USA study (using the American version) when testing 1606 students and 66 teachers. Using the Cronbach alpha coefficient, Wubbels and Levy (1991) reported internal consistency reliabilities ranging from 0.76 to 0.84 for student responses and from 0.74 to 0.84 for teacher responses.

Other international versions of the QTI have since been constructed. For instance, Kim, Fisher, and Fraser (2000) adapted a 48-item Australian version of the QTI for their study of secondary science classes in Korea. These authors provided further cross-validation information supporting the internal consistency of the QTI when the alpha reliability figures for the different QTI scales showed a range from 0.61 to 0.83. The $\eta^2$ statistic in this same study ranged from 0.14 to 0.25 for their adapted version of the QTI, which indicates that each scale of the QTI is capable of differentiating significantly between classes.

Telli, den Brok, and Cakiroglu (2007) developed a 62-item Turkish version of the QTI for their study on students’ perceptions of secondary science teachers. This version also displayed high Cronbach’s $\alpha$ coefficient of the eight scales at the class level (between 0.74 and 0.97) and their intra-class correlations (between 0.24 and 0.45) indicating that their instrument was capable of distinguishing between classes. These authors found that the correlation between the two dimensions (Proximity and Influence) was statistically nonsignificant. Similar to prior research (Brekelmans, Wubbels, & den Brok, 2002; den Brok, Brekelmans, & Wubbels, 2004),
analyses of the Turkish version revealed that students’ perceptions on the two continuum dimensions had predictive validity and both dimensions positively related to cognitive and affective student science outcomes.

Continuing research has shown that the QTI is an instrument uniquely qualified choice for this study. This instrument has been shown to have acceptable reliability and validity when used in Grades 7-12 (Wubbels, & Levy, 1993). den Brok (2001) confirmed through a review of over 20 studies that the reliability of the eight scales is sufficient and consistent across classes. Class level internal consistencies (Cronbach’s alpha) are generally above 0.80 (Rickards, den Brok, & Fisher, 2005). Brekelmans (1989) concluded that the data from the QTI is reliable if it is administered to at least 10 students per class. Additionally, the QTI only requires two classes per teacher to complete the questionnaire in order to achieve a reliable measure of overall style. The QTI was designed to measure the perceptions of teachers and students at the pattern level of systems approach to communication. The pattern level refers to when students and teachers have interacted over time which allows their mutual perceptions to be confirmed and reaffirmed, thus forming a stable basis for reactions (Wubbels & Brekelmans, 2005).

Mathematics Self-Efficacy Scale-Revised

The original Mathematics Self-Efficacy Scale (MSES) was developed to access college students’ math self-efficacy beliefs with greater specificity than previous instruments had thus demonstrated (Betz & Hackett, 1983). The MSES has 52 items and three subscales that represent three domains of math-related behavior: solving math problems, competing everyday life-type math tasks, and performing well in those college courses that require mathematical knowledge and mastery (Kranzler & Pajares, 1997).
The Mathematics Self-Efficacy Scale-Revised (MSES-R) (Betz & Hackett, 1983; Pajares & Miller, 1995) is a revised version of the MSES to investigate the math self-efficacy beliefs of high school students. Coefficient alphas of 0.90 (problems), 0.92 (courses), and 0.91 (tasks) have been reported for the MSES-R (Pajares & Miller, 1995). Pajares and Kranzler (1995b) used a version of the Problems subscale with high school students and reported a Cronbach’s alpha of 0.92.

In an exploratory factor analysis of the MSES-R, Kranzler and Pajares (1997) sampled 522 undergraduates from three different colleges and found the MSES-R to be a multidimensional measure of math self-efficacy with reliable subscales. These authors reported Cronbach’s coefficient alphas of 0.94 for Tasks, 0.91 for Courses, 0.91 for Problems, and 0.95 for full scale. It was concluded that since four first-order factors were identified, the scale does indeed tap different judgments.

**Sources of Mathematics Self-Efficacy Scale**

The Sources of Mathematics Self-Efficacy Scale (SMSES) that was used in this study is an adaptation of the 40-item instrument that was originally developed by Lent, Lopez, and Bieschke (1991) to access high school and college students’ sources of mathematics self-efficacy beliefs (Lent, Lopez, & Bieschke, 1991; Lent, Lopez, Brown, & Gore, 1996; Lopez, Lent, Brown, & Gore, 1997). This scale was constructed to assess the hypothesized four sources of general academic self-efficacy beliefs of middle school students, and consists of four 10-item scales. In no particular order, one scale addressed student perception of their performance accomplishments (e.g. “I received good grades in my high school math classes”), another targeted students’ perception of their academic vicarious experiences (e.g. “My favorite teachers were usually math teachers”), the next scale addressed students’ evaluations of the impact of
social persuasions (e.g. “My parents have encouraged me to be proud of my math ability”), and
the remaining scale was designed to uncover the influence of students’ physiological states
within the classroom (e.g. “I get really uptight while taking math tests”) (Lent et al., 1991).

There is a 50% distribution of positively and negatively worded statements within each
scale (Lopez & Lent, 1992). Pursuant to the age-group of this study, minor word changes were
necessary for relevance. Permission for these word changes was sought and granted by Dr. Lent
(R. Lent, personal communication, February 16, 2008). Previous research studies that
investigated the four sources of self-efficacy had reported α coefficients ranging from .80 to .86
for performance accomplishments, .56 to .87 for vicarious experience, .72 to .91 for verbal
persuasion, and .76 to .91 for emotional-physiological states (Anderson & Betz, 2001; Hampton,
1998; Klassen, 2004; Lent et al., 1991; Matsui, Matsui, & Ohnishi, 1990). The Cronbach α
coefficients for this scale were reported as .82 for performance accomplishments, .59 of
vicarious experience, .74 for verbal persuasions, and .90 for emotional-physiological states
(Lopez, & Lent, 1992).

Reliability and Validity

Creswell (2003) recommends the use of one to two of eight possible strategies in order to
check the accuracy of findings from qualitative investigations. The eight suggested strategies
include triangulating different data sources, having participants check final reports and specific
descriptions and themes for accuracy of their perceptions, using rich, thick description to convey
findings, clarifying the bias of the researcher, presenting negative or discrepant information that
runs counter to themes, spending prolonged time in the field, using peer debriefing to ensure the
account resonates with people outside of the study, and finding an external auditor to review the
entire project. The two strategies selected to ensure the reliability and validity of this
investigation were triangulating the data and utilizing peer debriefing. A fellow doctoral student at The University of Alabama was chosen as the reliability rater (i.e. peer debriefer). The practical argument transcripts were sent to the reliability rater for coding within pre-determined categories identified by the researcher. After the reliability rater completed the coding process, the researcher and reliability rater met to negotiate the placement of data within those categories.

Data Collection and Analysis

The data collection occurred during the fall academic semester of 2008. The research design is a three phase concurrent mixed methods. The first phase concentrated on quantitative data collection and analysis from the three surveys (i.e. MSES-R, QTI, SMSES) that were administered. The second phase concentrated on qualitative data collection and analysis. Focus groups were organized and a Representative class was chosen for classroom videotaping and soliciting pre-Algebra I test perceptions and beliefs. The third phase incorporated both quantitative and qualitative data collection and analysis. Post-administration of the three surveys occurred, final focus group interview was conducted, and selection of practical argument videotapes was completed.

First Phase

The time line for Phase One was 5 weeks. During this phase, the researcher distributed and then collected the parental consent and student assent letters and the demographic information forms (see Appendix E) from all students willing to take part in the study. Student assent and parent consent forms were given to 294 ninth and tenth grade students. After a two week period, the researcher had only received signed forms from her 60 students. Other mathematics teachers were consulted as to why their students did not want to participate. The general consensus of the teachers was that students were mistakenly thinking that they would be
videotaped if their parents agreed to participation in this study. The researcher then wrote a
follow up letter to the parents of students explaining that they would be granting permission for
their children to take three surveys at the beginning of the semester and again at the end of the
semester. The researcher went to the other teachers’ classrooms and explained to the students
what their part in the study would involve and gave a packet which included the new letter and
another student assent and parent consent form. Students were given an additional two weeks to
return the forms. Only 65 more students of the 294 returned signed forms for a total of 125
participants. Analysis of survey instruments resulted in the rejection of 28 student surveys due to
pre-only administration, patterning of responses, and incomplete surveys. This elimination
resulted in a total participation population of 97 ninth and tenth grade students.

Participating students were assigned a code number from a master list for identification
purposes. Each participant was issued a specific code that allowed for the identification of their
sex, race, grade, and mathematics classroom teacher. Each student used the code number on all
surveys and questionnaires to preserve their privacy. Demographic information (See Appendix
E) and the three surveys were collected from all participants. Anonymity was preserved by these
coding procedures. All data collections used in Phase One did not exceed a regular class period
(i.e. 50 minutes) and required three separate class meetings to complete.

The first survey, administered as a pre/post baseline continuum, was the Mathematics
Self-Efficacy Scale-Revised, (MSES-R) (Betz & Hackett, 1983, Pajares & Miller, 1995) (See
Appendix B). This particular mathematics self-efficacy survey is a revision of the original
survey initiated and validated specifically for its use with high school students. The second
survey, Sources of Mathematics Self-Efficacy Scale (SMSES) (Lent, Lopez, & Bieschke, 1991),
identified the informational sources that the participants acknowledge as most influential toward
their self-efficacy beliefs (See Appendix C). The third survey, Questionnaire on Teacher Interactions (QTI) (Wubbels & Levy, 1991), was used to identify students’ perceptions of their teacher’s interpersonal behavior in the mathematics classroom (See Appendix D).

Data collected were analyzed through a descriptive statistical program (i.e. SPSS, 1999). Descriptive statistics provided the basic summaries of the data that were needed for further analytical measures. For example, means scores from all three surveys were used to compare the researcher’s Algebra I students’ perceptions and beliefs to establish which of the three classes responded with the widest range of opinions.

Second Phase

Phase Two time line was 16 weeks. The researcher’s three Algebra 1A classes were video-taped during each six-week grading period. Descriptive statistics provided the information necessary for the selection of the Representative class. Factors in the choice of a Representative class included: a) the class that best represented a wide range of beliefs and perceptions, and b) the class that presented the least disruption to students’ schedules and routines. The Representative class was video-taped twice a week for 16 weeks. All tapings were viewed for the purpose of selecting one video from each six-week period to conduct a practical argument.

Data from the descriptive statistical analysis of the three surveys in Phase One were used to select potential candidates from the Representative class to participate in the focus group interviews. For example, the average total scale score for the MSES-R in the Representative class was 209.5. The students selected for the focus group had total MSES-R scale scores that ranged from the highest at 272 down to the lowest at 152. Twelve students were selected as potential candidates for the focus group. Familiar with the high absenteeism associated with the ninth grade, the researcher decided to establish a ‘pool’ of students that had agreed to participate
in the videotaped focus group interviews. The criteria for selecting students included: a) Students reporting mathematics self-efficacy beliefs above the mean, b) Students reporting self-efficacy beliefs below the mean, c) Students that perceived the researcher’s classroom interpersonal behavior as more dominant than cooperative, meaning the majority of their QTI survey responses would be graphed within the Influence dimension, and d) Students that perceived the researcher’s classroom interpersonal behavior as more cooperative than dominant, meaning that the majority of their QTI survey responses would be graphed within the Proximity dimension. Students had the option not to participate in the focus group. Three out of five students were constant members in all three interviews; two members were interchanged from the pool of twelve because of absenteeism. Even though members were interchanged, the focus group maintained a consistent range of perceptions and beliefs (i.e. low to high).

The participating students met with the researcher’s educator assistant, referred to as the focus group interview monitor, in an unoccupied classroom during regular school hours. The researcher’s educator assistant was chosen to conduct these interviews for the following reasons: 1) focus group interview students were also students of this educator; 2) this educator was familiar and comfortable with interview moderator role; and 3) this educator was able to arrange an interview schedule that was least disruptive to students’ school day. Those interviews were conducted within a 50 minute time period. The questions for the focus group interviews were developed from student responses on the researcher-developed Pre-Test Questionnaire. The questionnaire’s purpose was to elicit student perceptions in order to accomplish this.

The Pre-Test Questionnaire consisted of three questions that reflected theoretical tenets of three categories: mathematics self-efficacy beliefs, sources of those efficacy beliefs, and teacher classroom interpersonal behavior. Each of the three questions provided statements for
students to circle the closest fit to their perception. The first question asks students to choose the statement that best describes their perceived level (i.e. confident, somewhat confident, not confident) of ability for the mathematical objectives on the up-coming test. The second question asks students to choose among Bandura’s (1977) four sources of self-efficacy that best explains their level of efficacy for those upcoming test objectives. The third question asks students to choose the statement that best describes the recent classroom interpersonal behavior of the researcher (i.e. their mathematics teacher). In addition, each question provided the option for students to write down their own thoughts.

From tallying the results of the questionnaire, the researcher was able to let the students decide what questions they would be asked during the interview. For example, most students chose the statement, “The teacher lectured for 15 minutes because some of the students did not do their homework.” The focus group monitor asked the students opinion on those statements chosen by the majority of participants.

While all three Algebra I classes participated in the Pre-Test Questionnaire, the Representative class was video-taped twice a week during the semester. There were 32 total classroom video tapings. Three video-tapings were chosen and reviewed from each six-week period for a total of nine videos. Three of those nine videos were chosen for the practical argument. The practical argument identified the researcher’s in depth reflection of mathematics instruction practices, teaching beliefs and classroom interpersonal behaviors. Transcripts from the practical argument were coded for pre-determined categories that were identified by specific statements of beliefs, teaching strategies, and classroom behaviors (i.e. teaching beliefs, strategies, and behaviors that provide performance accomplishment opportunities, vicarious
experiences, identifiable forms of verbal persuasion, and appropriate attentive response to emotional-physiological states).

Third Phase

The time line for Phase Three was 6 weeks. The three surveys (MSES-R, QTI, and the SMSES) were administered to collect post perceptions. The data were compared to the pre-data sets to insure symmetry of participant code numbers. All surveys were examined for completeness as well as obvious patterns in the responses. For example, all the 3’s were marked on one page of the instrument. During this examination, twenty-eight surveys were eliminated from the data sets due to pre-administration only (i.e. absent and transferred students), obvious response patterns, and incomplete surveys.

Pre-scores from the MSES-R were averaged within each category (i.e. Task Self-Efficacy, Math Course Self-Efficacy, Problems Self-Efficacy, Non-Math Course Self-Efficacy) to establish baseline scores. These baseline scores were subtracted from the post-scores on the MSES-R. Campbell (1994) states, “It is often desirable to transform scores so that the sets of scores of interest have equal means and standard deviations. This transformation is obtained by adding or subtracting a constant from every score…” (p. 7). These differences were labeled the Self-Efficacy data set. The individual student responses from the pre-data from the other two surveys (i.e. QTI, SMSES) were subtracted from the post-data individual responses. The differences in pre-and post student responses were labeled the QTI data set and Sources data set. These three data sets (i.e. Self-Efficacy, QTI, Sources) were analyzed by descriptive statistics, t-tests, 2-way ANOVA, and Pearson correlation coefficient statistical programs. Descriptive statistics identified mean and standard deviation differences. T-test analysis determined which of those differences were significant. The 2-way ANOVA analysis determined whether those
differences could be attributed to the factors of race and sex and the Pearson correlation coefficient analysis was utilized to discover the relationships among and between the differences in students’ perceptions of mathematics self-efficacy, the sources of that efficacy, and the teacher classroom interpersonal behavior.

Transcription and coding from the final focus group interview was also completed during this phase. Open coding from the transcribed interviews identified the selection of themes. Those themes were then arranged in the pre-determined categories from the disciplinary literature (see Strauss & Corbin, 1990). The themes and the arrangement of themes within the categories were verified through a reliability rater. The focus group interview analysis was compared with the results of the descriptive statistics, t-tests, and Pearson correlation coefficient results. Corroborative and contrasting results were used to address the research questions of this inquiry (See Table 3).

Table 3

*Summary of Data Collection Methods by Research Question*

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Data Collection</th>
</tr>
</thead>
<tbody>
<tr>
<td>What changes, if any, occur in ninth and tenth grade students’ pre-and post perceptions of Bandura’s four sources of mathematics self-efficacy?</td>
<td>Pre- and Post</td>
</tr>
<tr>
<td></td>
<td>SMSES data</td>
</tr>
<tr>
<td></td>
<td>Focus Group Interview</td>
</tr>
<tr>
<td>What changes, if any, occur in ninth and tenth grade students’ perceptions of the teachers’ classroom interpersonal behaviors?</td>
<td>Pre- and Post QTI data</td>
</tr>
<tr>
<td></td>
<td>Focus Group Interviews</td>
</tr>
</tbody>
</table>

64
How do the changes in perceptions affect the relationships that may exist among ninth and tenth grade students’ perceptions of their mathematics self-efficacy beliefs, the sources of those beliefs, and their teachers’ interpersonal classroom behaviors?

How are Bandura’s four sources of self-efficacy addressed during one ninth grade’s Algebra I classroom instruction?

Practical Argument Procedure

After completion of 32 classroom video tapings (two each week during the first semester with the exception of two testing weeks), one videotaping from each of the three six weeks were chosen for viewing through a practical argument analysis. A practical argument is a two-phase process used to identify the researcher’s reasons that justified actions within the Representative class. The first phase, elicitation, clarifies the beliefs premising a teacher’s classroom actions. The second phase, reconstruction, justifies identified classroom practices. Reconstruction involves the comparison between the teacher’s justifications with current best practices. Using Dr. Shwery as the “other,” the tapes were examined to observe the researcher’s instructional beliefs and strategies. The questioning of the researcher’s teaching actions brought justification
to the researcher’s teaching beliefs. This conversation is called the practical syllogism and was audio taped.

Data transcription of the practical argument were coded for pre-determined categories that were identified by specific statements of teaching beliefs, identified teaching strategies and classroom behaviors such as teaching strategies, and behaviors that provide performance accomplishment opportunities, vicarious experiences, identifiable forms of verbal persuasion, and appropriate attentive response to emotional-physiological states. Strauss and Corbin (1990) remarked that category names can be formed from the concepts that researchers already have from their disciplinary or professional reading, or taken from the technical literature, or are the words and phrases used by the interviewees themselves. The practical argument data, survey data sets, and the focus group interview data were triangulated and discussed within the perimeter of this study’s questions.

Chapter 3 Summary

The purpose of this investigation was to find how within-year student perception changes may affect any relationship that exists between students’ perception of the teacher classroom interpersonal behavior and their math self-efficacy beliefs. The chapter described the self-study action research, methods and procedures, with a convenient cluster sample that responded to the four research questions. A mixed methods research design included the use of quantitative surveys and qualitative methods for triangulating the data. Instrumentation includes three reliable and valid surveys, the Mathematics Self-Efficacy Scale-Revised (MSES-R) (Betz & Hackett, 1983; Pajares & Miller, 1995), the Questionnaire on Teacher Interactions (QTI) (Wubbels & Levy, 1991), and the Sources of Mathematics Self-Efficacy Scale (SMSES) (Lent, Lopez, &
Bieschke, 1991). Data from the surveys were analyzed through descriptive statistics, t-tests, 2-way ANOVA, and Pearson correlation coefficient statistical programs.

Responses from Pre-test Questionnaires were examined to design the interview protocol for the first focus group interview. Practical argument and focus group interview data were used to triangulate with quantitative data. Chapter 4’s description of both quantitative and qualitative data analysis was organized by the study’s four research questions.
CHAPTER 4
RESULTS AND ANALYSIS

Introduction

This chapter describes the results and analysis of the study, which explored students’ perceptions of the teacher classroom interpersonal behavior, the sources of mathematics self-efficacy, and mathematics self-efficacy beliefs. A sequential three phase action research plan employed a mixed methodology in the exploration of the research questions of this study. Phase one, a quantitative phase, consisted of the pre-administration of the surveys, analysis of data to choose representative class and focus groups, and administration and analysis of Pre-test Questionnaires to create interview protocol. Phase two, a qualitative phase, included the videotaping of the researchers three Algebra IA classes for the practical argument and conducting focus group interviews. Phase three, a quantitative and qualitative phase, comprised the post administration of the surveys and the final focus group interview. Descriptive statistics, a two-way ANOVA, Pearson correlation coefficient, focus group interviews, and a practical argument were used to analyze the data from all three phases.

Participants

The population of this study included 97 ninth and tenth grade mathematics students from five courses taught in 15 different classes by five mathematics teachers, including the researcher. The five courses include Algebra I, Algebra IA, Algebra IB, Algebra II, and Geometry. The representative class consisted of 20 from the 32 enrolled students who elected to participate in
phase two and three. The population of 97 students was labeled as “All” (i.e. participants); the 60 students were labeled as “AW students” (i.e. students). The population labeled as “All” included 63 ninth grade and 34 tenth grade students. The All group included 37 males with 5 White males and 32 African-American males, along with 60 females, of whom 11 were White and 49 were African-American.

Analysis Results

Descriptive statistics, t-test, 2-way ANOVA and Pearson correlation coefficient were used to analyze quantitative data to address the guiding questions of this investigation. Questions 1-3 were addressed through the quantitative analysis followed by corroborating and contrasting data from focus group interviews’ qualitative analysis. Question 4 will be answered through the deconstruction of the practical argument and related focus group interview data. This provided triangulation with quantitative and qualitative data.

Question 1

What Changes, if Any, Occur in Ninth and Tenth Grade Students’ Pre- and Post Perceptions regarding Bandura’s Four Sources of Mathematics Self-Efficacy?

The Sources of Mathematics Self-Efficacy Scale (SMSES) (Lent, Lopez, & Bieschke, 1991) was used to access participants pre- and post perceptions. The instrument was designed to measure students’ perceptions of Bandura’s four sources of self-efficacy (i.e. Performance Accomplishments, Vicarious Experiences, Verbal Persuasion, and Emotional-Physiological States). Students rated ten relevant statements for each source on a 5-point Likert scale from strongly disagree to strongly agree. The instrument was administered during the first six weeks of the semester and again at the end of the semester (See Appendix C). Descriptive and t-test
analysis was conducted on the survey’s data to address the first research question. Table 4 presents the pre- and post means and standard deviations.

Table 4

*Pre and Post Means and Standard Deviations of the Sources of Mathematics Self-Efficacy by Group*

<table>
<thead>
<tr>
<th>Source</th>
<th>Mean Pre</th>
<th>Mean Post</th>
<th>Std. Dev. Pre</th>
<th>Std. Dev. Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performance Accomplishment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>33.18</td>
<td>30.25</td>
<td>5.90</td>
<td>7.41</td>
</tr>
<tr>
<td>AW students</td>
<td>32.62</td>
<td>28.62</td>
<td>5.83</td>
<td>7.74</td>
</tr>
<tr>
<td>Vicarious Experience</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>31.93</td>
<td>32.00</td>
<td>5.06</td>
<td>5.58</td>
</tr>
<tr>
<td>AW students</td>
<td>31.85</td>
<td>31.5</td>
<td>4.98</td>
<td>5.68</td>
</tr>
<tr>
<td>Verbal Persuasion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>35.68</td>
<td>34.67</td>
<td>5.57</td>
<td>6.03</td>
</tr>
<tr>
<td>AW students</td>
<td>35.55</td>
<td>34.10</td>
<td>5.83</td>
<td>5.91</td>
</tr>
<tr>
<td>Emotional-Physiological States</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>32.33</td>
<td>30.30</td>
<td>7.41</td>
<td>8.62</td>
</tr>
<tr>
<td>AW students</td>
<td>32.45</td>
<td>29.70</td>
<td>7.74</td>
<td>8.81</td>
</tr>
</tbody>
</table>

As indicated in Table 4 most mean scores decreased from pre- to post survey. This indicated that participants’ perceptions of Bandura’s sources had changed over the course of this
In both the All participants and AW student groups, perceptions of the source, Verbal Persuasion, had the highest post-mean scores. The result seemed to indicate that participants and students from both groups considered Verbal Persuasion to be the most important mathematics efficacy source. T-tests were conducted on the pre- and post scores differences to determine whether any significant change of perceptions had occurred. The results of the t-tests are shown in Table 5.

Table 5

_T-Test Results on Sources of Mathematics Self-Efficacy Scale by Group_

<table>
<thead>
<tr>
<th>Source</th>
<th>T-Score</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performance Accomplishments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AW students</td>
<td>4.124</td>
<td>.000**</td>
</tr>
<tr>
<td>All</td>
<td>4.258</td>
<td>.000**</td>
</tr>
<tr>
<td>Emotional-Physiological States</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AW students</td>
<td>2.391</td>
<td>.020*</td>
</tr>
<tr>
<td>All</td>
<td>2.378</td>
<td>.019*</td>
</tr>
</tbody>
</table>

Note: *p < .05 and **p < .01

The results from Table 5 show that in both groups, AW students and All participants, there were highly significant changes in participants’ perceptions of the Performance Accomplishments source. Participants’ perceptions of the source, Emotional-Physiological States, revealed significant change. Both results in Table 5 indicated that All participants and AW students relied less on their performance accomplishments and emotional-physiological states to influence their self-efficacy beliefs in mathematics. A 2-way ANOVA analysis revealed that the significant differences in All participants’ perceptions of the four sources of mathematics
self-efficacy were not caused by sex or race. However, the analysis of focus group interviews conflicted with the aforementioned quantitative findings. Before the conflicting results are presented, a brief overview regarding focus group membership and the interview protocol is discussed.

The Representative class students’ mean scores from all three surveys were used to compile a list of twelve students whose scores met the criteria (i.e. high to low range of perceptions). Eight of the 12 agreed to participate in the interviews. Due to the absentee rate at this school, two of the three focus group interviews varied in student participation. Five students were interviewed three times during the semester with three of the five students included in all three interviews. An educator of the same school was asked to serve as both researcher’s assistant and focus group interview monitor. This was done to insure that students’ responses to questions about the researcher would not be prejudiced in favor of the researcher.

The first focus group interview protocol was designed to reflect student responses from the Pre-Test Questionnaires that students filled out prior to their Algebra I tests during the investigation. The Pre-Test Questionnaire presented statements from the three constructs (i.e. self-efficacy, sources of self-efficacy, and teacher classroom interpersonal behavior) for the students to choose the statement that best described their beliefs and perceptions for the current test objectives. An example of the Pre-Test Questionnaire can be viewed in Appendix E. Interview questions were formed from the statements in each category most often selected by the majority of students.

Analysis of the focus group interviews divulged different results than those found in the t-test analysis. When asked to choose a statement on the Pre-Test Questionnaire that best represented the reason for their level of confidence to be successful with the Algebra objectives,
most students responded it was their math test scores and homework scores. For example, four of five students expressed:

“I usually do pretty good on the math tests because like I, like the majority of the time I do my homework and it helps me build up and get ready for the test.”

“It’s like the more homework you get the more you understand something about it.”

“If I make a low grade, it’ll make me feel not smart. And, like if I make a high grade, then I’ll feel like I’m smart.”

“It’s just the making a good grade, you make a bad grade, you kind of feel like you don’t know it. And then if you turn around and you make a good grade you feel like, hey, I’ve got this and I’ve learned this.”

These statements were validated in the second focus group interview when asked, “I want you to rate in order of importance the following things that are most important to your confidence level: Watching my classmates have success with mathematics; the way my teacher presents the material; I have not been as nervous about math this year; and, my test scores and homework scores this year.” Again, four out of the five students being interviewed responded that test scores and homework score rated as the most important influence toward their confidence in being successful in Algebra I. When asked to explain why they rated test and homework scores as the most important influence, three of the students responded:

“Because like the higher you have the test scores and stuff, that would make me feel, just more confident and it makes me feel like I better understand it and the way the teacher presents, then that way we could learn more about it afterwards.”

“Because it all count on your test scores where your confidence and how the teacher presents it for you to know how to do it.”
“Yeah, I agree to it because when you have a test grade, a good test grade, it shows that you understood what she taught and that you are kind of good in math and that brings your confidence up.”

There are several possibilities that might explain the discrepancies in participants’ survey responses and students’ focus group interviews. Students typically require an adjustment period from the transition of junior high to senior high school. Additionally, mathematics students often have difficulty accommodating the language, rules, and work ethic required of successful first year Algebra students. As a result, test and homework scores often fluctuate wildly during the first semester of Algebra I. The pre-SMSES responses on performance accomplishments were likely predicated on past success in mathematics, while the post-SMSES responses on performance accomplishments were predicated on their current success or lack thereof. The focus group student interviews showed that they considered their performance accomplishments to be an influential source of their mathematics self-efficacy beliefs.

Another significant change in both groups’ perceptions was found in the source, Emotional-Physiological States. In Table 5, AW students had a t-score of 2.391 and the All group’s data t-score was 2.378. Both of these scores indicated that participants’ dependence on Emotional-Physiological States for influencing their mathematics self-efficacy beliefs lessened during the semester. Student focus group responses were contradicting and complementary of the survey responses.

For instance, when students were asked, “Do you get nervous during math tests?”; and, “If so, what do you think about getting nervous?” two female students’ responded:

“I feel very nervous…I guess the tension that I have when, it’s like okay if I didn’t study for it like do more math problems and I’m afraid that I’m gonna make a failing grade. But that’s
what really makes me nervous because I wanna do…make a great grade and then I go back and I get like, I don’t make what I wanna do.”

“Sometimes I feel nervous because I wanna do well so like I wanna do so good then the test in front of me like, okay, and I don’t remember it at all. I guess because I’m so focused on doing well or doing really, really good it’s, it’s overwhelming sometimes.”

For the same question, two male students stated:

“No, I always feel comfortable even if I’m not passing, I still feel comfortable on tests I’m taking.”

“I don’t get nervous just because the simple fact like when I do get nervous like I end up messing up a lot more than I normally do. So like I learned just don’t be nervous about it, you’ll make what you make.”

The higher dependence on Emotional-Physiological States for efficacy information at the beginning of the semester is not difficult to understand. First, school administrators, teachers, and parents frequently remind ninth graders that every grade from this time forward determines their future success. Second, it is not uncommon for first year Algebra students to experience lower mathematics grades than previously achieved. The lower dependence on Emotional-Physiological States for efficacy information at the end of the semester can also be understood. As students progress through their first semester of Algebra I, many students adjust to the more stringent expectations. As one focus group student remarked, “So like I learned just don’t be nervous about it, you’ll make what you make.”

Question 2

What changes, if any, occur in ninth and tenth grade students’ perceptions of the teachers’ interpersonal classroom behaviors?
The Questionnaire on Teacher Interaction (QTI) (Wubbels & Levy, 1991) was used to access both groups’ (participants’ and students’) pre- and post perceptions of teacher classroom interpersonal behavior (See Appendix D). Both groups rated eight relevant statements for each of the eight teacher behavioral characteristics on a 5-point Likert scale from never to always (i.e. perception of how often teacher displays that characteristic) (See Appendix D). The All participant groups’ perceptions of teacher classroom interpersonal behaviors included four different mathematics teachers. The population of this study included 97 ninth and tenth grade mathematics students from five courses taught in 15 different classes by five mathematics teachers, including the researcher. The five courses include Algebra I, Algebra IA, Algebra IB, Algebra II, and Geometry. Algebra IA and Algebra IB, taught to ninth and tenth grade students, is the equivalent of Algebra I. The instrument was administered to all participants at the beginning and end of the academic semester. Descriptive statistics and t-test analysis addressed the second research question. Table 6 presents the pre- and post means and standard deviations.

Table 6

Pre and Post Means and Standard Deviations of Teacher Interpersonal Classroom Behaviors by Group

<table>
<thead>
<tr>
<th>Interpersonal Behavior</th>
<th>Mean Pre</th>
<th>Mean Post</th>
<th>Std. Dev. Pre</th>
<th>Std. Dev. Post</th>
<th>Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>2.88</td>
<td>2.76</td>
<td>.7720</td>
<td>.7643</td>
<td></td>
</tr>
<tr>
<td>AW students</td>
<td>3.00</td>
<td>2.79</td>
<td>.7409</td>
<td>.6610</td>
<td></td>
</tr>
<tr>
<td>Helping/Friendly</td>
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<tr>
<td>All</td>
<td>2.72</td>
<td>2.51</td>
<td>.7992</td>
<td>.7083</td>
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</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<td>------------------</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>AW students</td>
<td>AW students</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.84</td>
<td>2.46</td>
<td>.7469</td>
<td>.7450</td>
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</tr>
<tr>
<td></td>
<td><strong>Understanding</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>AW students</td>
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</tr>
<tr>
<td></td>
<td>2.74</td>
<td>2.52</td>
<td>.7328</td>
<td>.7672</td>
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<tr>
<td></td>
<td>2.81</td>
<td>2.39</td>
<td>.7352</td>
<td>.7509</td>
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</tr>
<tr>
<td></td>
<td><strong>SRF</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>AW students</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>1.53</td>
<td>1.17</td>
<td>.6551</td>
<td>.5894</td>
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<tr>
<td></td>
<td>1.45</td>
<td>0.94</td>
<td>.5760</td>
<td>.4536</td>
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</tr>
<tr>
<td></td>
<td><strong>Uncert</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>AW students</td>
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</tr>
<tr>
<td></td>
<td>0.90</td>
<td>0.72</td>
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<td></td>
<td>0.77</td>
<td>0.53</td>
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<td>.4033</td>
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<td><strong>Table 6 cont’d.</strong></td>
<td></td>
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</tr>
<tr>
<td></td>
<td><strong>Dissatisfied</strong></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>AW students</td>
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</tr>
<tr>
<td></td>
<td>1.12</td>
<td>1.24</td>
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<td>.7100</td>
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<td></td>
<td>1.14</td>
<td>1.34</td>
<td>.7110</td>
<td>.6272</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Admonishing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>AW students</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.64</td>
<td>1.71</td>
<td>.8298</td>
<td>.8112</td>
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</tr>
<tr>
<td></td>
<td>1.69</td>
<td>1.98</td>
<td>.8433</td>
<td>.6856</td>
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</tr>
<tr>
<td></td>
<td><strong>Strict</strong></td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>All</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.16</td>
<td>2.34</td>
<td>.6063</td>
<td>.5980</td>
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</tr>
</tbody>
</table>
The All participants and AW students groups both responded with their highest post mean scores in the dimension, Influence. This result indicated that all members of this sample considered their mathematics teachers to be more dominant than cooperative. In both groups, perceptions of the teacher’s Leadership (DC), Helpful/Friendly (CD), Understanding (CS), Student Responsibility/Freedom (SC), and Uncertain (SO) interpersonal behaviors had lessened as the semester progressed. Yet, the teachers’ interpersonal behaviors of Dissatisfied (OS), Admonishing (OD), and Strict (DO) increased perceptually in both groups. Table 6 includes two continuum dimensions (i.e. Influence, Proximity) that are the result of specific sum scores of the eight interpersonal behaviors. Influence = (.92*DC) + (.38*CD) - (.38*CS) - (.92*SC) - (.92*SO) - (.38*OS) + (.38*OD) + (.92*DO); Proximity = (.38*DC) + (.92*CD) + (.92*CS) + (.38*SC) – (.38*SO) – (.92*OS) - (.92*OD) – (.38*DO) (P. den Brok, personal communication, October 13, 2008). The Influence dimension measured the level of control that both groups

<table>
<thead>
<tr>
<th></th>
<th>Influence**</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Influence**</td>
<td></td>
<td>2.60</td>
<td>3.13</td>
<td>1.6215</td>
</tr>
<tr>
<td>AW students</td>
<td></td>
<td>3.02</td>
<td>3.79</td>
<td>1.3076</td>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>Proximity**</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>All</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proximity**</td>
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<tr>
<td>AW students</td>
<td></td>
<td>3.13</td>
<td>1.67</td>
<td>2.5635</td>
</tr>
</tbody>
</table>

*SRF = Student Responsibility/Freedom
** Influence and Proximity are characteristic sum scores representing two continuum dimensions: Influence (Dominance—Submission) and Proximity (Opposition—Cooperation)
believed the teachers had over the communication in the classroom. The Proximity dimension measured the affinity that both groups perceived occurred within the classroom communication process. Both groups’ perceptions of Influence increased, while each group’s perceptions of Proximity decreased during the academic semester. T-tests were conducted to determine whether these perception changes were significant. Table 7 lists those results.

Table 7

_T-Tests Results on Questionnaire on Teacher Interactions Survey by Group_

<table>
<thead>
<tr>
<th>Source</th>
<th>All</th>
<th>AW students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T-Score</td>
<td>Sig. (2-tailed)</td>
</tr>
<tr>
<td>Helpful/Friendly</td>
<td>2.156</td>
<td>.034*</td>
</tr>
<tr>
<td>Understanding</td>
<td>2.337</td>
<td>.022*</td>
</tr>
<tr>
<td>SRF***</td>
<td>4.536</td>
<td>.000**</td>
</tr>
<tr>
<td>Uncertain</td>
<td>2.173</td>
<td>.032*</td>
</tr>
<tr>
<td>Admonishing</td>
<td>------</td>
<td>------</td>
</tr>
<tr>
<td>Strict</td>
<td>-2.618</td>
<td>.010*</td>
</tr>
<tr>
<td>Influence</td>
<td>-2.793</td>
<td>.006*</td>
</tr>
<tr>
<td>Proximity</td>
<td>2.315</td>
<td>.023*</td>
</tr>
</tbody>
</table>

Note: *p < .05, **p < .01, and ***SRF = Student Responsibility/Freedom

The results revealed significant to highly significant changes in perceptions of Helpful/Friendly, Understanding, Student Responsibility/Freedom (SRF), Uncertain, and Strict interpersonal behaviors during the semester. However, AW students’ responses revealed a significant increase in their perceptions of the teacher interpersonal behavior, Admonishing. Perceptions of the Influence dimension increased over the semester, while perception of the
Proximity dimension decreased. In both the All and AW student groups, their classroom teachers were perceived as being less friendly, helpful, understanding, and uncertain. Additionally, both groups perceived their teachers as providing fewer opportunities for student responsibility and freedom during the semester. All participants and AW students perceived their teachers as more strict, but only the AW student group perceived the teacher as more admonishing. A 2-way ANOVA analysis revealed that the significant differences in both groups’ perceptions of teachers’ classroom interpersonal behaviors did not vary by race or sex. Not all of these results were corroborated during the focus group interviews.

For instance, when focus group students were asked, “Do you agree that you’re able to get help from your teacher?” four out of the five students answered in the affirmative. For clarification, the monitor asked students to provide an example. Four students said:

“Like when the teacher is giving us an example of a problem, she’ll stop until everybody gets it and ask everybody get it. If you don’t get it raise your hand and then some students will raise their hand, but I don’t get it. She’ll go all the way back and get you to keep going then she’ll stop again. But like do anybody get this. And if somebody raise their hand, she’ll go back and work the problem again and ...we don’t get it we raise our hand so we don’t get it and then she’ll explain it to us some more.”

“If you don’t understand you ask her the same question, she won’t mind saying it over to you.”

“Like to the paying attention, well, it helps me pay attention if I have an interesting teacher or if she’s not boring to watch. Like Ms. White, she’ll say something, you know, funny like pay attention. Or she’ll make learning fun; it’s not boring because normally I’d be asleep.”
“Because she’ll teach us math but then she’ll like help us at the same time, like she’ll make it interesting in math class, like she’ll show us new stuff. She’ll make us like the plan, she’ll help us with math. When other students that don’t understand it, she’ll help us.”

Even though participants’ and students’ responses indicated that they considered their teacher to be less helpful and friendly, focus group students’ responses clarify that they still consider their teacher as helpful and friendly. Another significant change was students’ increased perception of the behavior, Admonishing, meaning that teachers show anger quickly, often take students to task, and express irritation easily. Many students had remarked on the Pre-Test Questionnaire that the teacher lectured the whole class for 15 minutes because some of the students didn’t do their homework. When asked to comment on this, one of the students stated:

“I think it’s something that needs to be done because…it helps you to understand the work better. It can help you the next day and next day on how to get other stuff to do. So I think it’s always something that you need to do.”

Although one student thought the lecture was necessary, there were other responses that indicated confirmation of the t-test results. When asked to describe a bad day in math class, another student stated:

“People just come in class and talking and they’re getting up and standing up and just yelling and just make you aggravated and then the teacher just, ooooh. Just turns to a very, very bad day.”

Even when asked to describe a good day, another student’s remark seemed to reflect the finding that students’ view the teacher’s behavior as admonishing:

“Nobody comes in the classroom and say I don’t have my pencil, I forgot something in my book bag. Because they can’t go back and get it so…”
The responses from the focus group students clearly indicated that they do find their teacher’s classroom interpersonal behavior as Admonishing.

Question 3

*How do the changes in perceptions affect the relationships that may exist among ninth and tenth grade students’ perceptions of their mathematics self-efficacy beliefs, the sources of those beliefs, and their teachers’ interpersonal classroom behaviors?*

Mathematics Self-Efficacy Scale-Revised (MSES-R) (Betz & Hackett, 1983) was used to measure both groups’ pre- and post mathematics self-efficacy beliefs. Pre-scores from the four categories (i.e. mathematics tasks, future mathematics courses, mathematics problems, non-mathematics courses) on the MSES-R were averaged to establish four base-line scores. Each of the base-line scores were subtracted from the post MSES-R category scores. These differences established the data base for the MSES-R results. The data bases for the SMSES and QTI surveys were established by taking the pre- and post score differences from these two surveys. These three data bases were used to examine existing relationships. Rather than using the raw scores for the Pearson correlation, this study utilized these data bases of differences to examine potential relationships (See Figure 2). The Pearson correlation coefficient analysis was conducted to establish existing relationships between and among: 1) mathematics self-efficacy beliefs, 2) sources of those beliefs, and 3) teacher classroom interpersonal behaviors. Specifically, correlations were sought between participants’ and students’ mathematics self-efficacy beliefs and Bandura’s four sources of self-efficacy; mathematics self-efficacy beliefs and teacher classroom interpersonal behaviors; and, teacher classroom interpersonal behaviors and Bandura’s four sources of self-efficacy. Mathematics self-efficacy beliefs were measured by category: 1) Mathematics task self-efficacy (TaskSE), 2) Future mathematics courses self-
efficacy (MathSE), 3) Mathematics problem solving self-efficacy (ProblemsSE), and, 4) Future non-mathematics courses self-efficacy (NonMathSE). Table 8 lists the pre- and post mathematics self-efficacy mean scores and standard deviations from both groups. Tables 9 - 13 present the results from those Pearson correlation coefficient analyses.

Figure 2. Explanation of three data bases.

<table>
<thead>
<tr>
<th>Data Base</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>All MSES-R data</td>
<td>(Post All MSES-R scores - baseline averages**)</td>
</tr>
<tr>
<td>AWS* MSES-R data</td>
<td>(Post AWS* MSES-R scores – baseline averages***)</td>
</tr>
<tr>
<td>Sources data</td>
<td>(Pre-Sources scores – Post Sources scores)</td>
</tr>
<tr>
<td>QTI data</td>
<td>(Pre-QTI scores – Post QTI scores)</td>
</tr>
</tbody>
</table>

**baseline averages  =  (All Pre-MSES-R scores / 97)
**baseline averages  =  (AW students Pre-MSES-R scores / 60)

Note: AWS* = AW students

Table 8 lists the pre- and post scores from both research groups. The results indicated that All participants’ and AW students’ mathematics self-efficacy beliefs decreased during the semester, with the lone exception of a slight increase in the All participants’ efficacy beliefs toward problem solving (ProblemsSE). Both research groups’ post mean scores indicated that their highest level of self-efficacy was toward mathematics tasks (TaskSE).
Table 8

*Mathematics Self-Efficacy Pre- and Post Means and Standard Deviations by Group*

<table>
<thead>
<tr>
<th>SE Category</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>Pre</td>
<td>Post</td>
</tr>
<tr>
<td>TaskSE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>4.2077</td>
<td>4.0984</td>
</tr>
<tr>
<td>AW students</td>
<td>4.1632</td>
<td>4.1188</td>
</tr>
<tr>
<td>MathSE</td>
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<td></td>
</tr>
<tr>
<td>All</td>
<td>3.9943</td>
<td>3.6518</td>
</tr>
<tr>
<td>AW students</td>
<td>3.9296</td>
<td>3.6056</td>
</tr>
<tr>
<td>ProblemsSE</td>
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<td></td>
</tr>
<tr>
<td>All</td>
<td>4.0515</td>
<td>4.0665</td>
</tr>
<tr>
<td>AW students</td>
<td>4.1606</td>
<td>4.0773</td>
</tr>
<tr>
<td>NonMathSE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>3.8363</td>
<td>3.7191</td>
</tr>
<tr>
<td>AW students</td>
<td>3.8208</td>
<td>3.7833</td>
</tr>
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</table>
Table 9

*Relationships between Mathematics Self-Efficacy and Sources of Mathematics Self-Efficacy for All Participants*

<table>
<thead>
<tr>
<th>N=97</th>
<th>TaskSE</th>
<th>MathSE</th>
<th>ProblemsSE</th>
<th>NonMathSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Accomplishments</td>
<td>-.130</td>
<td>.108</td>
<td>-.048</td>
<td>-.052</td>
</tr>
<tr>
<td>Vicarious Experiences</td>
<td>.069</td>
<td>.048</td>
<td>.206*</td>
<td>-.056</td>
</tr>
<tr>
<td>Verbal Persuasion</td>
<td>.133</td>
<td>.289**</td>
<td>.057</td>
<td>.058</td>
</tr>
<tr>
<td>Emotional-Physiological States</td>
<td>-.050</td>
<td>.190</td>
<td>.126</td>
<td>-.077</td>
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</tbody>
</table>

Note: *p < .05; **p < .01

The results in Table 9 revealed a significant positive relationship between the source, Vicarious Experiences, and the participants’ self-efficacy for solving mathematics problems. A highly significant positive relationship was shown to exist between the source, Verbal Persuasion, and participants’ self-efficacy for success in future mathematics course, MathSE. These positive relationships indicate that participants’ self-efficacy beliefs toward solving mathematics problems and being successful in future mathematics courses are positively affected by peer and teacher modeling (i.e. Vicarious Experiences) and positive feedback (i.e. Verbal Persuasion). AW students’ correlations results were slightly different from the results shown for All participants (See Table 10). Analysis of both groups revealed a significant relationship between the source, Verbal Persuasion, and Math Course self-efficacy, but the All groups’ perceptions...
revealed a highly significant relationship while the AW students’ perceptions just showed a significant relationship.

Table 10

*Relationships between Mathematics Self-Efficacy and Sources of Mathematics Self-Efficacy for AW Students*

<table>
<thead>
<tr>
<th>N=60</th>
<th>TaskSE</th>
<th>MathSE</th>
<th>ProblemsSE</th>
<th>NonMathSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Accomplishments</td>
<td>-.158</td>
<td>.141</td>
<td>.052</td>
<td>.017</td>
</tr>
<tr>
<td>Vicarious Experiences</td>
<td>.017</td>
<td>.078</td>
<td>.127</td>
<td>-.054</td>
</tr>
<tr>
<td>Verbal Persuasion</td>
<td>.034</td>
<td>.301*</td>
<td>.205</td>
<td>.076</td>
</tr>
<tr>
<td>Emotional-Physiological States</td>
<td>.004</td>
<td>.270*</td>
<td>.106</td>
<td>.129</td>
</tr>
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</table>

Note: *p < .05; **p < .01

Table 10 reveals two positive significant relationships between AW students’ self-efficacy toward success in future mathematics courses and their perceptions of Verbal Persuasion and Emotional-Physiological States. These results indicated AW students’ dependence on positive feedback (i.e. Verbal Persuasion) was related to their beliefs of ability toward success in future mathematics courses. Additionally, the results revealed that students gauged ability perceptions to be successful in future mathematics courses by the degree of interest or emotional connection to mathematics (i.e. Emotional-Physiological States).

The focus group interview data provided some evidence to support these results in Table 10, while other responses indicated contrasting evidence. When students were asked whether or
not what others said about their mathematics ability had any effect on their confidence in mathematics, two of the five students responded:

“Usually sometimes people tell me like I’m good in math and then I’ll go back and make like a failing grade sometimes in math and I be thinking like well they just told me I could do this, I could do that. And just make me feel all confident. Again I go back and I do my homework and I get it right.”

“I got to go along with her, because some people do be…they’ll tell me like you make good grades and all, but I think I can do better that the things I do. I know I make passing grades most of the time, but I think I can do better and it do make me confident and I do listen to what people say because it make me feel strong and a better person than what I am in math. And it make me build up my strength to do more math problems and I like to get challenged in math problems and that usually make me feel real confident in math.”

These students’ comments indicated others were a ‘source’ of their mathematics ability perceptions. Two other students’ responses contradict the quantitative findings as well as the corroborated comments of the two students. For example, when asked whether it was important to them that their friends thought they were good math students or not, contrasting comments were made by two other students:

“It’s not real important to me because like I don’t need them to think that I’m great in math even though I think I’m pretty good in it. It ain’t real important if they think it, just as long as I think of it.”

“Yeah, I think if I’m good in math then I’m good, but I don’t think I need the approval, you know, of friends. I just don’t think I do.”
Although these comments seem to contradict the results that indicated a significant relationship between Verbal Persuasion and students’ perception of future success in mathematics courses, when asked whether it mattered or not if their teacher thought they were good in math, these same two students including one other student responded:

“Well like I wouldn’t, first of all I’d prefer them [teachers] to think I was real good in math because it just make me feel even more dumb if they thought I was bad at math”

“If she, I mean, it was nice to hear praise from people if the teacher is the person that gives you a test and they say well you’re pretty good at it. You can pass that test because that feels good because they’re the ones giving the test so they should know. I think it’s good to get positive reinforcement from the teacher.”

“Even if you are doing bad in math, they can tell you in a nice way, then that will make you wanna go home and do your notes and study more and get a good grade. I mean, even if you’re good they can encourage you to keep doing well in math.”

It seemed clear from these students’ responses that their perception of ability was closely tied to the positive feedback they get from their teacher. These responses seem to verify the significant relationship found through quantitative analysis.

Another positive significant relationship found through quantitative analysis was between students’ self-efficacy for future success in mathematics courses and Emotional-Physiological States. When asked, “Do you agree that if somebody’s told you you’re good in math that makes you feel more confident or do you listen to what people say about you as a student?”, corroboration for this relationship was expressed in one student’s response:

“I think sometimes people think I’m smarter than I am. This is how I feel personally. Other students are like, can you help me with this? And I’m like I really don’t know how to do
this. Well you look like it. And I’m like, I might look like I know how to do it, but I really don’t. I think…I’m smart, but I’m not a genius, like some people in math, because I was like in sixth grade, fifth grade…math was nothing and then was like I know math; I’ll do it, you know. People like can you help me, I help you all the time. But now, I’m like I can’t help myself.”

The focus group monitor asked the student to explain what had changed since fifth and sixth grade in mathematics. The same student replied:

“I think it’s…like I’m not as interested in math as I use to be. I use to love math. Well I mean, I don’t care as much, I mean I don’t love it as much as I used to.”

The two comments made by this student showed that the student attributed decline in perception of math ability to the lack of emotional connections to mathematics. As emotional connections to mathematics increased, student perceptions of mathematical ability seem to increase.

The QTI was used to elicit All participants’ perceptions of teacher classroom interpersonal behavior. The SMSES was used to access All participants’ perceptions of the most influential source toward their mathematics self-efficacy beliefs. Table 11 lists the significant relationships found between All participants’ perceptions of teachers’ classroom interpersonal behaviors and the sources of mathematics self-efficacy beliefs.
Table 11

*Relationships between Teachers’ Classroom Interpersonal Behaviors and Sources of Mathematics Self-Efficacy for All Participants*

<table>
<thead>
<tr>
<th></th>
<th>Leadership</th>
<th>Helpful/Friendly</th>
<th>Understanding</th>
<th>SRF</th>
<th>Uncertain</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA</td>
<td>.150</td>
<td>.196</td>
<td>.260*</td>
<td>.162</td>
<td>-.042</td>
</tr>
<tr>
<td>VE</td>
<td>.172</td>
<td>.304**</td>
<td>.303**</td>
<td>-.216*</td>
<td>-.193</td>
</tr>
<tr>
<td>VP</td>
<td>.211*</td>
<td>.212*</td>
<td>.300**</td>
<td>.166</td>
<td>-.075</td>
</tr>
<tr>
<td>E-PS</td>
<td>.226*</td>
<td>.304**</td>
<td>.415**</td>
<td>.013</td>
<td>-.156</td>
</tr>
</tbody>
</table>

Note: *p < .05; **p < .01; PA=Performance Accomplishment; VE=Vicarious Experience; VP=Verbal Persuasion; E-PS=Emotional-Physiological States; SRF=Student Responsibility/Freedom.

Table 11 (cont’d)

*Relationships between Teachers’ Classroom Interpersonal Behaviors and Sources of Mathematics Self-Efficacy for All Participants*

<table>
<thead>
<tr>
<th></th>
<th>Dissatisfied</th>
<th>Admonishing</th>
<th>Strict</th>
<th>Influence</th>
<th>Proximity</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA</td>
<td>-.236*</td>
<td>-.196</td>
<td>-.245*</td>
<td>-.059</td>
<td>.287**</td>
</tr>
<tr>
<td>VE</td>
<td>-.325**</td>
<td>-.258*</td>
<td>-.048</td>
<td>.236*</td>
<td>.333**</td>
</tr>
<tr>
<td>VP</td>
<td>-.348**</td>
<td>-.213*</td>
<td>-.265**</td>
<td>-.014</td>
<td>.346**</td>
</tr>
<tr>
<td>E-PS</td>
<td>-.413**</td>
<td>-.314**</td>
<td>-.278**</td>
<td>.068</td>
<td>.441**</td>
</tr>
</tbody>
</table>

Note: *p < .05; **p < .01; PA=Performance Accomplishment; VE=Vicarious Experience; VP=Verbal Persuasion; E-PS=Emotional-Physiological States.
Highly significant positive relationships were found to exist between Vicarious Experience and the behaviors, Helpful/Friendly and Understanding; Verbal Persuasion and Understanding; Emotional-Physiological States and the interpersonal behaviors Helpful/Friendly and Understanding. The dimension, Proximity, was also found to have a highly significant positive relationship with all four of the mathematics sources of self-efficacy. Participants indicated that helpful, friendly, and understanding teachers exert more self-efficacy influence through their positive feedback, modeling, and caring attitudes. Participants’ perceptions of cooperative communication among peers and teachers within the classroom (i.e. Proximity) were shown to be related to all four sources of mathematics self-efficacy.

Significant positive relationships were found between Verbal Persuasion and the interpersonal behaviors, Leadership and Helpful/Friendly; Performance Accomplishments and Understanding; and Emotional-Physiological States and Leadership. A significant positive relationship was shown to exist between Vicarious Experience and the dimension, Influence. These results designated that those teachers who ran organized and structured classrooms (i.e. Leadership) may have influenced their students’ mathematics self-efficacy beliefs through their positive feedback and their ability to help their students make emotional connections to mathematics. Participants’ responses revealed that their dependency on the influence of mathematical success (i.e. Performance Accomplishments) was enhanced by caring teachers. Also, participants’ responses indicated that the influence of teacher modeling was increased by their increased perception of classroom communication controlled by the teacher (i.e. Influence).

Participants’ perceptions of the teacher behavior, Dissatisfied, revealed highly significant inverse relationships with Vicarious Experience, Verbal Persuasion, and Emotional-Physiological States. Participants’ perceptions of the teacher behavior, Strict, indicated a highly
significant inverse relationship with two of the sources, Verbal Persuasion and Emotional-Physiological States. Emotional-Physiological States were also shown to have a highly significant inverse relationship with the teacher behavior, Admonishing. These results make known that teachers ability to influence their students’ mathematics self-efficacy beliefs through modeling, positive feedback, and facilitating emotional connections were diminished when students perceived them as dissatisfied and strict. Additionally, teachers perceived as angry and irritated (i.e. Admonishing) toward their students were less able to help students make positive emotional connections to mathematics was weakened.

Significant inverse relationships were found to exist between Performance Accomplishments and the teacher behaviors, Dissatisfied and Strict; Vicarious Experience and Student Responsibility/Freedom and Admonishing; and, Verbal Persuasion and Admonishing. These results provided evidence that teachers who were perceived as dissatisfied, strict, admonishing, and too controlling of students’ learning (i.e. Student Responsibility/Freedom) were decreasing the influence they could exert over participants’ mathematics self-efficacy beliefs through student mathematics success, modeling, and positive feedback.

Relationships were also found to exist between teacher classroom interpersonal behaviors and the four sources of mathematics self-efficacy when examining students’ perceptions from the AW students (See Table 12).
### Table 12

**Relationships between Teacher Classroom Interpersonal Behaviors and Sources of Mathematics Self-Efficacy for AW Students**

<table>
<thead>
<tr>
<th>N=60</th>
<th>Leadership</th>
<th>Helpful/Friendly</th>
<th>Understanding</th>
<th>SRF</th>
<th>Uncertain</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA</td>
<td>.220</td>
<td>.255*</td>
<td>.327*</td>
<td>.182</td>
<td>-.040</td>
</tr>
<tr>
<td>VE</td>
<td>.206</td>
<td>.368**</td>
<td>.264*</td>
<td>-.158</td>
<td>-.083</td>
</tr>
<tr>
<td>VP</td>
<td>.259*</td>
<td>.227</td>
<td>.318*</td>
<td>.115</td>
<td>-.051</td>
</tr>
<tr>
<td>E-PS</td>
<td>.296*</td>
<td>.382**</td>
<td>.459**</td>
<td>.064</td>
<td>-.093</td>
</tr>
</tbody>
</table>

Note: *p < .05; **p < .01; PA=Performance Accomplishment; VE=Vicarious Experience; VP=Verbal Persuasion; E-PS=Emotional-Physiological States; SRF=Student Responsibility/Freedom.

### Table 12 (cont’d)

**Relationships between Teacher Classroom Interpersonal Behaviors and Sources of Mathematics Self-Efficacy for AW Students**

<table>
<thead>
<tr>
<th>N=60</th>
<th>Dissatisfied</th>
<th>Admonishing</th>
<th>Strict</th>
<th>Influence</th>
<th>Proximity</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA</td>
<td>-.288*</td>
<td>-.226</td>
<td>-.206</td>
<td>-.029</td>
<td>.341**</td>
</tr>
<tr>
<td>VE</td>
<td>-.326*</td>
<td>-.308*</td>
<td>-.168</td>
<td>.175</td>
<td>.355**</td>
</tr>
<tr>
<td>VP</td>
<td>-.417**</td>
<td>-.254</td>
<td>-.262*</td>
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<td>.371**</td>
</tr>
<tr>
<td>E-PS</td>
<td>-.469**</td>
<td>-.380**</td>
<td>-.235</td>
<td>.077</td>
<td>.497**</td>
</tr>
</tbody>
</table>

Note: *p < .05; **p < .01; PA=Performance Accomplishment; VE=Vicarious Experience; VP=Verbal Persuasion; E-PS=Emotional-Physiological States.

In Table 12, highly significant positive relationships were shown to exist between the teacher behavior, Helpful/Friendly, and the sources, Vicarious Experience and Emotional-Physiological States. Emotional-Physiological States positive relationship to the teacher.
behavior, Understanding, was also highly significant. All four sources of mathematics self-efficacy were shown to have highly significant positive relationships to the dimension, Proximity. Significant positive relationships were shown to exist between the following sources, and the teacher behaviors: Performance Accomplishments and Helpful/Friendly, Understanding; Verbal Persuasion and Leadership, Understanding; Vicarious Experiences and Understanding; and, Emotional-Physiological States and Leadership. These results indicated that teachers, who are perceived as helpful, friendly, understanding, and as creating a classroom atmosphere of cooperative communication (i.e. Proximity) are more capable of influencing students’ mathematics self-efficacy beliefs through modeling, students’ mathematics success, positive feedback, and making emotional connections to mathematics. The significant relationships found that teachers who are perceived as caring and maintain an organized, structured classroom are also capable of influencing students’ mathematics self-efficacy beliefs through students’ mathematics success, positive feedback, modeling, and helping students to make emotional connections with mathematics.

The data in Table 12 represented existing highly significant inverse relationships between the teacher behavior, Dissatisfied, and the sources, Verbal Persuasion and Emotional-Physiological States. One other highly significant inverse relationship existing was found between Emotional-Physiological States and the teacher behavior, Admonishing. Significant inverse relationships were also found to exist between the source, Vicarious Experience, and the teacher behaviors, Dissatisfied and Admonishing. Other significant inverse relationships were found to exist between Performance Accomplishments and Dissatisfied and between Verbal Persuasion and the teacher behavior, Strict. The teacher perceived as criticizing and grim (i.e. Dissatisfied) was less able to influence efficacy beliefs through positive feedback. The teacher
perceived as angry and irritated (i.e. Admonishing) was less able to influence efficacy beliefs through students’ mathematics success. The teacher perceived as exacting and intolerant (i.e. Strict) was less able to influence efficacy beliefs through making emotional connections to mathematics.

Student responses during focus group interviews provided corroboration for the significant positive relationships found to exist between the source, Performance Accomplishments, and the teacher behaviors, Helpful/Friendly and Understanding. Interview responses additionally provided corroborating evidence for the significant positive relationships found between the teacher behavior, Leadership, and the sources, Verbal Persuasion and Emotional-Physiological States. When asked how student success while working on the blackboard impacted them, one student responded:

“Because I think you’ll feel good about any subject when the teacher says you’re doing good and she keep calling you to the board and make you think she thinks I’m smart. Or, you know, I’m doing something right and she keeps calling you to the board or calling on you for answers and stuff so it makes you feel smart. Makes you feel better towards the subject.”

This response indicated that the student’s perception of the teacher’s classroom leadership behavior was positively related to the positive feedback and emotional connection to the subject. When focus group students were given the opportunity to talk regarding their feelings about math or how other people made them feel about math, one student stated:

“The good thing about math, I feel good about math when we go over homework in class. Because when I don’t get it right, like she’ll say if I have any questions on any of the problems. I’m like, I didn’t understand number so and so. And she’ll go over it like okay. And it’s always like the most of the time when I do something, it’s always a little mistake that throws the whole
problem off, and I feel better when she point it out. And she’s not mean about it. She’s like it just this one little thing you got wrong, so I feel really good when we go over homework in class.” This student’s statement provided evidence that success with mathematics was related to the teacher’s helpful and understanding behaviors.

The QTI measured participants’ perceptions of the teacher classroom behavior and the MSES-R measured participants’ mathematics self-efficacy beliefs. Existing relationships between these perceptions are identified in Table 13.

Table 13

*Relationships between Mathematics Self-Efficacy Beliefs and Teachers’ Classroom Interpersonal Behaviors for All Participants*

<table>
<thead>
<tr>
<th></th>
<th>N=97</th>
<th>Leadership</th>
<th>Helpful/Friendly</th>
<th>Understanding</th>
<th>SRF</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Task SE</td>
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<td>.037</td>
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<td>-.011</td>
<td>-.083</td>
<td>-.064</td>
</tr>
<tr>
<td>Math Course SE</td>
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<td>.087</td>
<td>.127</td>
<td>.174</td>
<td>.213*</td>
<td>.067</td>
</tr>
<tr>
<td>Problems SE</td>
<td></td>
<td>-.005</td>
<td>-.015</td>
<td>.040</td>
<td>.011</td>
<td>-.056</td>
</tr>
<tr>
<td>Non-Math Course SE</td>
<td></td>
<td>.082</td>
<td>.024</td>
<td>.017</td>
<td>.096</td>
<td>.026</td>
</tr>
</tbody>
</table>

Note: *p < .05; SRF = Student Responsibility/Freedom
Table 13 (cont’d.)

*Relationships between Mathematics Self-Efficacy Beliefs and Teacher Classroom Interpersonal Behaviors for All Participants*

<table>
<thead>
<tr>
<th></th>
<th>N=97</th>
<th>Dissatisfied</th>
<th>Admonishing</th>
<th>Strict</th>
<th>Influence</th>
<th>Proximity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task SE</td>
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<td>-.025</td>
<td>-.195</td>
<td>.024</td>
<td>.043</td>
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<tr>
<td>Math SE</td>
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<td>-.065</td>
<td>-.138</td>
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<td>.157</td>
</tr>
<tr>
<td>Problems SE</td>
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<td>-.058</td>
<td>-.080</td>
<td>-.032</td>
<td>.033</td>
</tr>
<tr>
<td>Non-Math SE</td>
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<td>.013</td>
<td>.005</td>
<td>.032</td>
<td>.003</td>
<td>.020</td>
</tr>
</tbody>
</table>

Note: *p < .05; SRF = Student Responsibility/Freedom

Table 13 shows only one positive significant relationship between Math Course SE and Student Responsibility/Freedom. The result indicated that participants’ self-efficacy beliefs toward future success in mathematics courses were related to how much classroom responsibility and freedom they perceived provided by their teacher.

Focus group interview responses do corroborate Table 13’s finding. When asked by the focus group monitor, “What is it that makes you feel like you’re a good math student?” two students replied:

“I think when like my teacher’s at the board and she’s writing down and then I write it down and then I go home and I study it over it will make me think I’m a good math student.”

“I feel like a good math student when I go to the board and work it out.”

These statements indicated their perception of responsibility and freedom within the classroom was related to their mathematics efficacy. Correlations found between AW students’ mathematics self-efficacy beliefs and their perceptions of teacher classroom interpersonal behaviors are represented in Table 14.
### Relationships between Mathematics Self-Efficacy Beliefs and Teacher Classroom Interpersonal Behaviors for AW Students

**Table 14**

<table>
<thead>
<tr>
<th></th>
<th>Leadership</th>
<th>Helpful/Friendly</th>
<th>Understanding</th>
<th>SRF</th>
<th>Uncertain</th>
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<tr>
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<tr>
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<td>-.119</td>
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<tr>
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<td>.114</td>
<td>-.040</td>
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</table>

Note: *p < .05; SRF = Student Responsibility/Freedom

**Table 14 (cont’d.)**

<table>
<thead>
<tr>
<th></th>
<th>Dissatisfied</th>
<th>Admonishing</th>
<th>Strict</th>
<th>Influence</th>
<th>Proximity</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>Non-Math SE</td>
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<td>-.050</td>
<td>-.115</td>
<td>-.012</td>
<td>.093</td>
</tr>
</tbody>
</table>

Note: *p < .05

Two significant inverse relationships were found between AW students’ mathematics self-efficacy beliefs and their perceptions of teacher classroom interpersonal behavior. Students’ Task Self-Efficacy was found to be inversely related to both teacher behaviors, Student Responsibility/Freedom and Strict. Interestingly, the All participants’ group self-efficacy beliefs for future success in mathematics courses were positively related to the amount of responsibility
and freedom they perceived teachers provided in the classroom; however, AW students’ self-efficacy beliefs for math tasks were inversely related to the amount of responsibility and freedom they perceived the teacher provided within their classrooms. One possible explanation could be in a focus group students’ response when asked to discuss the way they felt about math:

“It’s not that I don’t like math, it’s just that I don’t like the harder math and when I learn it, then it don’t bother me. But like the hard part is learning…Well, it’s just a lot of work. A lot of work don’t bother me, just some stuff take me a while to get.”

The mathematics tasks in Algebra I were more involved and sometimes took longer to “get” than the procedures related to previous mathematics courses. It is reasonable to expect that students’ introduction to these longer and often more complicated procedures in Algebra I during the first semester did shake their confidence in their mathematics tasks abilities. For example, students were expected to combine their knowledge of order of operation, variables on both sides of the equation, and solving multi-step equations within singular problems this semester.

The other significant inverse relationship found was between Task Self-Efficacy and the teacher behavior, Strict. It is possible to view this inverse relationship as an expected one. An example of students’ perception of strict teachers would be the type of rules and the rigid adherence to those rules enforced by teachers. The mathematics tasks of Algebra I involve many rules and procedures that teachers must enforce to enable their students to be successful.

Question 4

*How are Bandura’s four sources of self-efficacy addressed during one ninth grade’s Algebra I classroom instruction?*

A transcribed and coded practical argument syllogism was used to address the final question of this investigation. Three classroom video tapings that occurred during the three six-
week periods of the academic semester were chosen for the elicitation phase of the practical argument. During this phase, the ‘other,’ Dr. Shwery, elicited the researcher’s teaching beliefs from the videotaped classroom vignettes involving teacher interpersonal behaviors and teaching strategies. During the reconstruction phase, the practical argument syllogism was audio-taped, transcribed, and then coded for the researcher’s teaching beliefs and justified actions. The researcher and reliability rater negotiated those coded beliefs and actions. Beliefs and actions were then organized independently into Bandura’s four sources of self-efficacy. These organizations were also negotiated between the researcher and reliability rater for rigorous fit among the four sources. The following narrative of coded data was presented within the four sources of self-efficacy.

**Performance Accomplishments Source**

One of the vignettes in the video tapes observed the researcher discussing how simple, yet difficult it can be to become better students in all of their subjects. The following excerpts from the syllogism followed that observation:

*Other: So what do you mean by simple and hard?*

*Researcher: Well, it’s not difficult to do but sometimes, well most of the time a lot of people have a hard time being that disciplined.*

*Other: You’re comparing your class and what you are wanting and encouraging in your students to do in math with science and social studies or history. Why are you doing that?*

*Researcher: I’m trying to get across to them that it’s not just the mathematics that this works in. That it is going to work no matter what class you are in. Sometimes students like math because there’s not a lot of reading.... I want them to understand that as far as learning is concerned it is applicable to all subjects.*
Other: Which is what are you trying to get across?

Researcher: I am trying to help them become better students. Because the more that they are able to do that...because right now everything to them is grades....So it is not atypical, it’s just that is what it is. So, what I’m trying to do is help them find ways to get their grades up because once their grades go up they will become more involved in school. They will want to be in school. They will want to do their homework...Well, you know, it will have a self-efficacy type rolling effect with it...As long as their grades are as low as they are, then they are not going to change their habits, which is they don’t bring books or supplies to class. They don’t take their books home, and they do not do their homework, you know...a large majority of my ninth grade students.

The practical argument data and focus group interview data were triangulated to provide students’ perceptions of the researcher’s teaching beliefs and strategies. Student responses during the focus group interview seem to corroborate the researcher’s teaching belief that performance accomplishments are important to their perceptions of mathematics ability. When asked to talk about what makes them feel good about mathematics, four of the students responded:

“Because if you make bad, then your confidence drops, but if you’re doing good, then it goes up so I think that plays a big part in confidence.”

“It’s kind of like when you turn in your homework and you get a good grade or your test grade is good then that means that you really get it. And, oh, I did get it, so now I can do anything.”

“And like if you flunk a test, you’ll probably will go home and study and study for the next test so you can make better. And like if you make better you’ll feel pride, you’ll feel real proud of yourself.”
“All I can say is getting better because grades have been coming up and more activity has been prepared and stuff. We’re doing and learning more.”

These focus group interview responses point out the importance that teachers remain aware how students’ success in the mathematics classroom feeds their perceptions of ability which in turn possibly leads to increased mathematics success for students.

Another vignette observed involved the researcher in an exchange with a student within the classroom. The following excerpts from the syllogism followed that observation:

Other: What was going on there?

Researcher: He was showing me something about his homework.

Other: Now, when you do this, do you sometimes ask students, who had it correct and, how did you do this?

Researcher: Right. One of the things that we had started doing, which I don’t do every day because it takes up so much time, is that every student turns in their homework as soon as they come to class. If they have attempted all the problems that were assigned, then they receive full credit for their homework that day... Then I will go around the room and call on each student to go to the board and put one of the homework problems on the board. They have to do the problem without their homework paper, but if they get the problem correct they will receive an additional five points on their homework grade that day. They love the fact that they get extra points and being able to show everybody that they know how to do the problem. As a result, more students are starting to do their homework every night.

Student responses during the focus group interview indicated that students agreed with the uncovered teaching belief that when students demonstrated their knowledge publicly, it was
beneficial to their confidence in mathematics. While discussing how going to the board during class affected their confidence in mathematics, four of the five members stated:

“Yeah, I think it’s a positive because going to the board, it can show you right then and there whether you get it or not. Because if you don’t get it, that’s okay, just go back to your desk and look over the examples till you get it. And then if you still don’t get it, don’t get mad, just go back to the board and try again.”

“Usually, when I do go to the board for some stuff and do get it wrong, she is going to always ask you to come to the board and show her how you got your answer…then she gonna show you how to get the right answer. And it’s gonna show you how to get the correct answer and then it’s gonna show you how to do the rest of the problems right. And that makes you feel more confident.”

“Because like if I get something right on the board and like, I go back to my desk. I have a big smile on my face and I think, ‘Hey, I’m smart,’ because I got mine right. Yeah, it makes me feel really good when I get it right like with no help and it be like okay so I feel confident when I go sit down.”

“And it makes the teacher like, call on you more and a lot of students don’t get it and it makes you feel smart and it won’t make students look down on you. And like, they’ll want you to tutor them for like a math problem or something so it makes you feel real smart.”

The teaching belief uncovered through these reconstructions revealed that performance accomplishments are a powerful and effective source of students’ mathematics self-efficacy beliefs. The focus group interview responses from students seemed to corroborate that teaching belief.
During this classroom vignette, the researcher was observed modeling a procedure for mentally adding two-digit numbers. This excerpt from the syllogism followed that observation:

Other: Why are you demonstrating how to add mentally?
Researcher: Every once in a while I will show the students that sometimes mental addition is actually quicker and easier than using the calculator.
Other: Explain that a little more for me.
Researcher: Well, in this case the students were required to add 87 and 19 in order to complete the order of operation problem. So, I try to get them to see how 19 is the same as 20 minus 1; therefore, it would be easier to add 20 to 87 equaling 107, and then subtract 1. That is 106 which equals 87 plus 19.
Other: Oh, okay.
Researcher: On multiples of ten, it is so much easier to do that and because I have noticed that my students have a problem with adding nines, eights, and sevens. So I am trying to get them to see the patterns mentally by using the Distributive Property.
Other: Well, I can see where they would think of those numbers as strange.
Researcher: Right. So I tell them to add 10, subtract 1, for adding 9: add 10, subtract 2, for adding 8: and, add 10, subtract 3, for adding 7. And if you can learn to do that, then you will start to see those adding patterns and will be able to add just about anything mentally.

The researcher’s teaching belief regarding Vicarious Experience was once again observed during a classroom vignette in which the researcher was correcting a student’s statement about a one-step equation.
Other: Why did you correct what that student was saying about the equation?

Researcher: Well, believe it or not, that becomes a very big issue later on in Algebra.

Other: How do you mean?

Researcher: Their verbiage.

Other: I was wondering about that. What did they say? And how did you correct it?

Researcher: They said that they subtracted 3X from 4. I told them no, that is not what the equation says. The equation tells us that they subtracted 4 from 3X. This is something that my students find to be difficult.

Other: Okay, so what is the difference?

Researcher: The difference is that one answer would be a positive number and the other answer would be negative. They are so used to always translating a verbal sentence into a symbolic sentence in the same order that I am trying to get them to realize that the way the sentence is written can make a difference in that order....And knowing how to say it and what it sounds like, and what it means, makes a huge difference in their ability to translate from verbal to symbolic and from symbolic back to verbal.

These reconstructions have shown that modeling successful mathematical habits, as well as mathematical procedures, plays a vital role within the classroom identifying mathematical misconceptions. These vicarious experiences provided possible opportunities for changing students’ perceptions of their mathematical abilities. Focus group interview responses indicated that students regard teacher modeling as an important factor in their perception of mathematics abilities. When asked why students said they were more confident in math this year compared to last year, three students responded:
“Because I get help from the teacher and when she’s showing me how to do my work, I’m like okay, I get this and I get that. And she’s like well that’s good that you get it and then as soon as the test gets here I make a passing grade on it. So I’m feeling more confident when she shows me stuff I learned.”

“I’d say Miss White because she’s explaining it out a lot more than my old teacher did.”

“Because she’s like breaking it down more to our better understanding, and I learn better when it’s written down.”

Other corroborating responses were found when students were asked why they thought the way the teacher presented material in class was the second most important influence to their mathematics confidence. Two of the five focus group members stated:

“Because if she presents it in a way that I can understand then I can do better on my homework and that helps me be successful with more homework and tests.”

“Like when she’s presenting it, if I do understand it then I’ll like write my notes and I study them and I’m like okay. So then when she turns around and gives us a test and I have a good grade…I, okay, it doesn’t register that I actually learned something until I get my test back. So I think the way she present it have big, big part in how I do on my homework and how I really do on the test grade.”

These students’ responses indicated that their perceptions of mathematical ability were influenced by the modeling experiences they had within the mathematics classroom.

*Verbal Persuasion Source*

During a homework review vignette, the researcher was observed engaging students to ask more questions.

*Other: Why are you talking about asking questions?*
Researcher: If I think that some of the students still don’t understand the lesson or if I am not sure whether I understand their question, then I want them to clarify it….Because I know that I will not address their problem if I don’t understand their question.

Other: I also noticed that you were trying to elicit more questions, why is that?

Researcher: I was trying to tell them not to wait for somebody else to ask your question. Even if they think that the same question has been asked by another student, then I still want them to ask their question on that same problem….Because I may not answer your question the same way that I would answer the other student’s question and you might need more explanation or just a different explanation.

Other: Why do you think that is important?

Researcher: Because I am trying to encourage them to be verbally active during class.

When focus group students were asked to describe how it made them feel when the teacher encouraged them to ask questions during class, one student responded:

“Yeah, it gives you more confidence to ask questions. It show that she care about your ability to learn it.”

The focus group monitor then asked this student if it mattered whether the teacher cares about your ability to learn, this same student stated:

“Yeah, I think it matters.”

This student’s response seems to corroborate the teaching belief that students need to be encouraged to ask questions in the mathematics classroom. Students’ focus group interview responses gave evidence that positive verbal persuasion was important to their mathematics self-efficacy beliefs.
Another classroom observation provided evidence that Verbal Persuasion was considered a major factor during classroom discussions.

Other: You just praised them. Why did you praise them?
Researcher: Because there were so few requests to ask me to repeat the same answer.
That meant everyone was really paying attention that day.
Other: Do they often ask you the same question?
Researcher: Yes, they often ask for me to repeat the same answer several times, in addition to asking me to work the same problem over and over.
Other: So they are not paying attention?
Researcher: Yes, they are often distracted during class, so when they do pay attention I try to acknowledge their good student behavior....I am trying to encourage them to break their bad educational habits and replace them with good educational habits. I often talk with them about how they have the ability to be successful they just need to develop the concentration and work habits that will make use of that ability.

Students seemed to agree with the researcher’s teaching belief that positive verbal persuasions could act as mathematics efficacy influencing factors. When students were asked by the focus group monitor to describe what is happening this year to make them feel more confident in mathematics, two students responded:

“Like last year when we were teached it was like…I mean we’re kids, but we were taught like come to the class like you don’t know anything. But this year, she’s like, okay, I know you know this so, it builds this and this builds on this and it makes you feel like you know more, you feel smarter.”
“Yeah, when she asks you to come to the board, and then you get it right and she’s like, ‘Oh, you got it right.’ That really makes me feel smart.”

Although Bandura (1997) acknowledged that negative verbal persuasions were more lasting and powerful than positive verbal persuasions, these observed vignettes and focus group interview responses indicated that the researcher and students believed that positive verbal persuasions were important mathematics efficacy influences.

*Emotional-Physiological States Source*

The following excerpt from the syllogism occurred when the researcher was observed working several homework problems that the students had asked to see.

*Other:* Why did you leave everything up on the board when you are working different problems?

*Researcher:* Because a lot of students are slow to copy the problems down and I’ve learned that if you write something on the board and then immediately erase it, those slower students will panic. I had been told several times by their parents that they felt like I was not giving them enough time to copy notes during class.

*Other:* Have you thought about leaving just the last problem up on the board while you work the next problem and then remove the earlier one?

*Researcher:* I have done that before, but usually I just leave as much up on the board as I possibly can. Because too many times in the past when I was erasing the earlier problems, some of the students would ask me to wait because they had not gotten to that problem yet. I have so many different skill levels within the same classroom that I try to listen when they tell me something gives them difficulties. And if leaving the problems on the board longer makes them feel better about the lesson, then that is what I will do.
Another reconstruction from the syllogism demonstrated that the emotional-physiological states of students were considered to be an important teaching belief:

*Other: Why are you converting the decimals to fractions?*

*Researcher: I told them that I was doing the problem this way because I don’t like working with decimals. I want them to understand that even as a math teacher there are parts of mathematics that I don’t like either. I understand that my students don’t like fractions and I am trying to identify with that disliking and even fear of working with fractions.*

*Other: So there is more than one way to get the correct answer?*

*Researcher: Yes, I encourage my students to bring a calculator to class everyday because I want them to learn the concepts without getting caught up on the basic skills. I want them to convert fractions to decimals when it’s possible and use their calculators. I am hoping that if I admit to my dislike of decimals along with the demonstration that I still use them when I need to, then they might begin to see fractions in the same way.*

*Other: Now why are you saying a dollar for tax?*

*Researcher: I was trying to explain why fractions and decimals are not only important in mathematics but also very important to their daily lives. So I asked them whether or not they thought we should just get rid of fractions altogether and they said yes, we should. So, I asked them to tell me how much their favorite soft drink costs and they said 73 cents with tax. So I told them, well, in your new world without fractions, that soft drink doesn’t cost 73 cents anymore. It now costs two dollars. Because the drink now cost a dollar and the tax will have to be a dollar. I was hoping that by showing them how necessary partial numbers are then they would find them more interesting.*
These reconstructions indicated that the researcher believes students’ perception of ability can be negatively affected by fear and anxiety, but also those perceptions can be positively affected by a student’s interest and liking for mathematics.

Focus group interview responses gave evidence that Emotional-Physiological States can positively and negatively affect students’ mathematics self-efficacy beliefs. When focus group students were asked to describe the classroom events that did not make them feel smart, two students stated:

“Like when she’s teaching a problem and everybody gets it but you. You’re the only person that don’t get the problem, that’ll make you feel…And she’ll be like, don’t be afraid to raise your hand if you don’t know it. But it’s like, I don’t understand and people look at you like you don’t understand; it’s so easy, but, if you don’t understand, you just don’t. And it’s kind of scary to ask a question. I mean, she’s very inviting, like ask a question if you don’t understand. But, classmates are like, you don’t understand it, it’s so easy…And that makes you feel dumb.”

“I’m like when you do your homework it’s like if you want to do this number [on the blackboard], you can do it and you’re like I know I got it right. And you get up there and she’s like, you know, it’s not quite right. You know, like, oh, I thought I had it right, but I didn’t. And that is very frustrating.”

These two students’ responses indicated that when students are frustrated or fearful of social condemnation of their ability, then Emotional-Physiological States become more influential toward their mathematics efficacy. Three other students in the focus group interview gave responses that indicated a positive influence from their Emotional-Physiological states. When asked why they thought the way the teacher presents material was important to their confidence in mathematics, these three students declared:
“It’s just the way she teaches it, just brings it out. She can be teaching to everybody, but it’s like she’s teaching it to you and even if you know it, it’s like she brings it out in a whole different perspective.”

“Because if she’s boring, then you’d be like it’s pointless and I don’t wanna try so you just fail. But if she’s interesting, you’ll be like maybe I can pass math if I pay attention, you know.”

“Well, as far as I can say, she’s just doing a good job teaching. She has taught me a lot of stuff and more than I learned last year. Grades have been improving, I’m making more friends, and I’m starting to love math.”

These focus group interview responses serve as a reminder that as students experience varying emotional reactions within the mathematics classroom, teacher beliefs and awareness of these emotional states can provide efficacy-building opportunities.

Chapter 4 Summary

Chapter 4 presented the results of this study divided by each research question and triangulated quantitative and qualitative analysis of data. Descriptive statistics, t-tests, and a 2-way ANOVA revealed the significant changes in students’ perceptions of the sources of their mathematics self-efficacy beliefs and teacher classroom interpersonal behaviors. For example, highly significant differences indicated a decreased reliance on the source, Performance Accomplishment, but students’ responses from focus group interviews revealed that success within the mathematics classroom was still an influential mathematics efficacy source. Pearson correlation coefficient tests revealed the significant relationships between and among: a) mathematics self-efficacy beliefs, 2) perceived sources of those beliefs, and 3) students’ perceptions of teacher classroom interpersonal behaviors. An example of this includes the highly
significant positive relationships found between the sources, Vicarious Experience, Verbal Persuasion, and Emotional-Physiological States, and the teacher classroom interpersonal behavior, Understanding. Practical argument analysis provided evidence of the researcher’s teaching beliefs and strategies that aligned with Bandura’s (1997) four sources of self-efficacy. For instance, supporting evidence found the positive efficacy influence that a teacher can utilize through encouraging student interest and liking of mathematics.

Chapter 5 presents the conclusions, interpretations, and recommendations from findings found in Chapter 4. This chapter will follow the same organization as Chapter 4.
CHAPTER 5
CONCLUSIONS AND RECOMMENDATIONS

Introduction

The purpose of the study was to investigate how within-year differences in perceptions may have affected any existing relationships between teacher classroom interpersonal behaviors and mathematics self-efficacy beliefs. The investigative focus of this study was three-fold: 1) determine whether students’ perceptions of teacher classroom interpersonal behaviors and the sources of their mathematics self-efficacy changed significantly during the academic semester; 2) investigate how those changed perceptions affected any existing relationships among and between students’ perceptions of mathematics self-efficacy beliefs, the sources of those beliefs, and teacher classroom interpersonal behaviors; and 3) reflective focus on the researchers’ teaching beliefs and strategies that provide students opportunities to experience Bandura’s four sources of self-efficacy within the mathematics classroom. Descriptive statistics, t-tests, 2-way ANOVA, and Pearson correlation coefficient analysis was used to measure perception differences and existing relationships. Focus group interview data provided triangulation with quantitative data. A practical argument analysis was used to discover the researcher’s teaching beliefs and strategies. Chapter 5 presents the conclusions, data interpretations, supporting literature, and recommendations for future research. The organization of Chapter 5 will replicate that of Chapter 4.
Question 1

What Changes, if Any, Occur in Ninth and Tenth Grade Students’ Pre- and Post Perceptions regarding Bandura’s Four Sources of Mathematics Self-Efficacy?

Descriptive statistics revealed that both groups’ (All participants and AW students) responses indicated students’ perceptions of all four sources decreased over the semester, with the single exception of a slight perceptual increase in Vicarious Experience reported by the All participant group. Post mean scores indicated that participants and students perceived Verbal Persuasion as the most influential source of their mathematics self-efficacy. This result conflicts with the literature. Although studies within the current literature that focused on the four sources of self-efficacy concentrated on correlation analysis, their results concluded that Performance Accomplishments was the most influential source of self-efficacy beliefs (Hampton, 1998; Klassen, 2004; Matsui, Matsui, & Ohnishi, 1990). This study seems to be the first investigation focused on whether students’ perceptions of the sources change over time and circumstances. T-test analysis revealed that the changes in perceptions’ toward Performance Accomplishments and Emotional-Physiological States were significant.

Focus group interview data analysis indicated results more in line with the literature. Students’ responses indicated that they considered Performance Accomplishments as the most influential efficacy source. The following responses made by focus group students indicated that agreement:

“If I make a low grade, I’ll make me feel not smart. And, like if I make a high grade, then I’ll feel like I’m smart.”
“It’s just the making a good grade, you make a bad grade, you kind of feel like you don’t know it. And then, if you turn around and you make a good grade, you feel like, hey, I’ve got this and I’ve learned this.”

“Because like the higher you have the test scores and stuff, that would make me feel, just confident and it makes me feel like I better understand it…”

“Yeah, I agree to it because when you have a test grade, a good test grade, it shows that you understood what she taught and that you are kind of good in math and that brings your confidence up.”

There are several possibilities that might explain the contrasting results found in participants’ survey responses and students’ focus group interviews. Students typically require an adjustment period from the transition of junior high to senior high school. Additionally, mathematics students often have difficulty accommodating the language, rules, and work ethic required of successful first year Algebra students. As a result, test and homework scores often fluctuate wildly during the first semester of Algebra I. It is important to note that both research groups showed statistically that the downward change in perceptions of Performance Accomplishments was significant. The focus groups chosen for this study were representative groups of the AW student research group. Therefore, the responses of these groups should only be viewed as representative of the ninth-grade Algebra IA students within this study. The focus group student interviews showed that they considered their performance accomplishments to be an influential source of their mathematics self-efficacy beliefs.

Another possible explanation for the differences in students’ quantitative and qualitative responses could be how students’ interpreted the survey statements. For example, one item on the survey read, “I have always had a natural talent for math.” Students who feel that they have
to work very hard to be successful in mathematics may not feel ‘naturally talented’ in comparison with peers that seem to have success with less effort. This does not mean that these same hard-working students’ self-efficacy is not influenced by their perception of their performance accomplishments.

Responses from the focus group interview also revealed conflicting opinions regarding Emotional-Physiological States as a source of mathematics self-efficacy beliefs. While two students indicated that tension and nerves affected their confidence in mathematics, two other students revealed that nervousness did not play a role in their efficacy perception formations.

“I feel very nervous…I guess the tension that I have when, it’s like okay if I didn’t study for it like do more math problems and I’m afraid that I’m gonna make a failing grade. But that’s what really makes me nervous because I wanna do…make a great grade and then I go back and I get like, I don’t make what I wanna do.”

“Sometimes I feel nervous because I wanna do well so like I wanna do so good then the test in front of me like, okay, and I don’t remember it at all. I guess because I’m so focused on doing well or doing really, really good it’s, it’s overwhelming sometimes.”

“No, I always feel comfortable even if I’m not passing, I still feel comfortable on tests I’m taking.”

“I don’t get nervous just because the simple fact like when I do get nervous like I end up messing up a lot more than I normally do. So like I learned just don’t be nervous about it, you’ll make what you make.”

The higher dependence on Emotional-Physiological States for efficacy information at the beginning of the semester is not difficult to understand. First, school administrators, teachers, and parents frequently remind ninth graders that every grade from this time forward determines
their future success. This additional pressure to succeed, along with the emotional transition to a new school with new teachers, could elevate how students interpret their emotional-physiological states. Second, that same transition could be interpreted by some students as a fresh start in a new school where academic problems of the past might be corrected. The excitement of this new chance could elevate the way students perceive their mathematical abilities. The lower dependence on Emotional-Physiological States for efficacy information at the end of the semester can also be understood. As students progress through their first semester of Algebra I, many students adjust to the more stringent expectations which results in a less nervous reaction to meeting those expectations. Also, it is not uncommon for first year Algebra students to experience lower mathematics grades than previously achieved. Lower grades oftentimes equate to lower interest in that particular subject; therefore, students’ perception of the positive emotional influences would lessen.

Question 2

*What changes, if any, occur in ninth and tenth grade students’ perceptions of the teacher’s interpersonal classroom behavior?*

Mean scores revealed that in both research groups, perceptions of the teacher behaviors most associated with the Proximity dimension (i.e. Leadership, Helpful/Friendly, Understanding, Student Responsibility/Freedom) along with the behavior, Uncertain, decreased during the study, while perceptions of those interpersonal behaviors most associated with the Influence dimension (i.e. Dissatisfied, Admonishing, Strict) increased during the semester. Therefore, it is not surprising that mean scores also indicated a perceptual increase of teacher-centered classroom communication (Influence) and a perceptual decrease in the cooperative classroom communication (Proximity) among both groups. These differences in students’ perceptions of
teacher classroom interpersonal behaviors within the Influence and Proximity dimensions were verified through t-test analysis. Both groups’ results reported that the differences were significant. T-test analysis also revealed that students found their teacher to be more admonishing and strict.

The QTI was designed to measure the perceptions of teachers and students at the pattern level of the systems approach to communication. The pattern level refers to when students and teachers have interacted over time which allows their mutual perceptions to be confirmed and reaffirmed, thus forming a stable basis for reactions (Wubbels & Brekelmans, 2005). Therefore, the previous studies followed the strong recommendation of the QTI’s authors that only one administration of the survey was necessary (Brekelmans, 1989; Henderson, 1995; Goh & Fraser, 2000; Wubbels & Brekelmans, 2005). The choice to administer the QTI as a pre- and post survey was validated by t-test analysis that showed significant differences in perceptions are possible. This is contrary to the authors’ recommendation that perceptions would remain stable.

The decision to use the QTI as a pre- and post survey can serve a beneficial purpose within the secondary mathematics classroom. Secondary students must adjust their perceptions of teacher classroom interpersonal behaviors each academic year and sometimes each academic semester depending on whether or not their school has block scheduling. It is beneficial to understand how these short-term relationships might change and how those changes could affect students’ self-efficacy beliefs.

Focus group interviews analysis revealed that although students’ perception of the teacher as helpful and friendly had lessened, the teacher was still perceived as helpful and friendly.
“Like when the teacher is giving us an example of a problem, she’ll stop until everybody gets it and ask everybody get it. If you don’t get it raise your hand and then some students will raise their hand, but I don’t get it. She’ll go all the way back and get you to keep going then she’ll stop again. But like do anybody get this. And if somebody raise their hand, she’ll go back and work the problem again and ...we don’t get it we raise our hand so we don’t get it and then she’ll explain it to us some more.”

“If you don’t understand you ask her the same question, she won’t mind saying it over to you.”

“Like to the paying attention, well, it helps me pay attention if I have an interesting teacher or if she’s not boring to watch. Like Ms. White, she’ll say something, you know, funny like pay attention. Or she’ll make learning fun; it’s not boring because normally I’d be asleep.”

“Because she’ll teach us math but then she’ll like help us at the same time, like she’ll make it interesting in math class, like she’ll show us new stuff. She’ll make us like the plan, she’ll help us with math. When other students that don’t understand it, she’ll help us.”

The conflicting results between quantitative and qualitative findings can be explained when considering how lower academic track students often interpret getting help from the teacher. Often students can develop an over-dependence on asking the same questions and expecting those questions to be answered repeatedly. For example, students will often ask their teachers for the rule on adding negative numbers every time they encounter that type of problem. Teachers have a responsibility to acknowledge students’ dependence, but also to facilitate those students in assuming learning responsibility. As teachers attempt to shift the learning responsibility on to the student, it is reasonable to conclude that those students would think of their teachers as less helpful and friendly.
Another byproduct of teaching students to take responsibility for their learning is that students may perceive that behavior as admonishing and strict. The responsibility of the teacher is to find ways to facilitate students with learning responsibility without being overly grim and exacting. Focus group interview responses indicated that students perceived their teacher’s interpersonal behavior as Admonishing.

“People just come in class and talking and they’re getting up and standing up and just yelling and just make you aggravated and then the teacher just, ooooh. Just turns to a very, very bad day.”

“Nobody comes in the classroom and say I don’t have my pencil, I forgot something in my book bag. Because they can’t go back and get it so…..”

There are numerous demands on today’s mathematics classroom teacher. Administration, classroom management, diplomacy, innovative instruction, and discipline issues are just a few of the long list of duties that teachers must accomplish on a daily basis every hour of the school day. With that understanding, it is crucial that all teachers (including the researcher of this study) understand how their interpersonal classroom behaviors are perceived by their students and the positive or negative impact those perceptions could incur.

Question 3

*How do the changes in perceptions affect the relationships that may exist among ninth and tenth grade students’ perceptions of their mathematics self-efficacy beliefs, the sources of those beliefs, and their teachers’ interpersonal classroom behaviors?*

Although descriptive statistics revealed that All participants’ and AW students’ mathematics self-efficacy beliefs decreased during the academic semester, t-test analysis of those differences showed that the only significant change occurred in students’ self-efficacy regarding
their success in future mathematics courses. This result adds to the literature in that these 
descriptive statistics and t-test analysis results reveal a glimpse of how students’ mathematics
self-efficacy beliefs might change during the school year without designed interventions. The
Pearson correlation coefficient analysis indicated that significant positive relationships were
found to exist for the All participants group between Vicarious Experiences and mathematics
problem solving self-efficacy beliefs (ProblemsSE). Emotional-Physiological States and future
success in mathematics courses self-efficacy (MathSE) were found to be a significant positive
relationship for the AW student group. Both groups’ results revealed a significant positive
relationship between Verbal Persuasion and efficacy beliefs toward future success in
mathematics courses. These findings have corroborated with existing literature. Lopez and Lent
(1992) found that emotional-physiological states had a significant level of efficacy belief
influence. Matsui, Matsui, and Ohnishi (1990) concluded that vicarious experience and
emotional-physiological states uniquely contributed to undergraduates’ mathematics self-
efficacy beliefs. More recently, Klassen (2004) reported that Indo Canadian students’
mathematics self-efficacy beliefs were more strongly influenced by vicarious experience and
verbal persuasion than did Anglo Canadian students. Hampton and Mason’s (2003) self-efficacy
study concluded that all four sources collectively were significantly related to high school
students’ self-efficacy beliefs. This study investigated whether changes in perceptions would be
related. Although, Performance Accomplishments was found to significantly decline over the
semester that decline was not found to be related to changes in students’ mathematics efficacy
beliefs.

The findings of this study contrast with the literature in that all of those studies found a
significant positive relationship existed between performance accomplishments and students’
self-efficacy beliefs and this investigation did not. Although Bandura (1997) suggested that performance accomplishments are typically the most influential source of self-efficacy beliefs, he never qualified the contribution to efficacy beliefs from the other three sources. He went on to say that “generalizations about the relative power of different modes of efficacy influence must be qualified by the sway of interacting influences” (p. 88). Students’ history of academic experiences, specifically mathematical experiences, that resulted in low efficacy beliefs may look to the other sources to provide the mathematics self-efficacy needed for persistence toward future success.

Intra-corroboration for these significant positive relationships was found in the results from Questions 1 and 2. Verbal Persuasion was listed as the most influential source as reported by both the All participants group and the AW student group. Results also revealed that both groups’ dependence on Performance Accomplishments and Emotional-Physiological States as sources of their efficacy beliefs declined significantly as the semester progressed. Additional corroboration was found in focus group interview responses.

“Usually sometimes people tell me like I’m good in math and then I’ll go back and make like a failing grade sometimes in math and I be thinking like well they just told me I could do this, I could do that. And just make me feel all confident. Again I go back and I do my homework and I get it right.”

“I got to go along with her, because some people do be…they’ll tell me like you make good grades and all, but I think I can do better that the things I do. I know I make passing grades most of the time, but I think I can do better and it do make me confident and I do listen to what people say because it make me feel strong and a better person than what I am in math. And it
make me build up my strength to do more math problems and I like to get challenged in math problems and that usually make me feel real confident in math.”

These focus group responses seemed to indicate that their efficacy is upwardly affected by the positive evaluative feedback they received from peers. While these responses refer to the influence of peers, there was evidence that the perception of efficacy influence from teachers was as strong. A student’s response speaks to this influence.

“If she, I mean, it was nice to hear praise from people if the teacher is the person that gives you a test and they say well you’re pretty good at it. You can pass that test because that feels good because they’re the ones giving the test so they should know. I think it’s good to get positive reinforcement from the teacher.”

Bandura (1997) noted that individuals will only trust those evaluations of their abilities from persons that they perceive to be sufficiently skilled or knowledgeable about what it takes to master that particular task. The above students’ response seemed to speak directly to this statement on Verbal Persuasions. Usher and Pajares (2008) remarked, “Researchers have yet to include items tapping students’ trust in those who try to convince them of their academic capabilities, nor have they separated messages received from same-age peers and those received from adults” (p. 758). These authors posit that attempting to measure verbal persuasions without attending to these issues results in an incomplete picture of the source. This study has partially attempted to address these issues by seeking the relationships between Bandura’s four sources of self-efficacy and students’ perceptions of teacher classroom interpersonal behavior.

Pearson correlation coefficient analysis revealed that both groups’ (All participants and AW students) perceptions of teacher classroom interpersonal behaviors were shown to have the following significant relationships to the four sources of mathematics self-efficacy beliefs: 1)
Leadership was positively related to both Verbal Persuasions and Emotional-Physiological States; 2) Helpful/Friendly was positively related to both Vicarious Experiences and Emotional-Physiological States; 3) Understanding was positively related to all four sources; 4) Dissatisfied was inversely related to all four sources; 5) Admonishing was inversely related to both Vicarious Experiences and Emotional-Physiological States; and 6) Strict was inversely related to Verbal Persuasion.

The cumulative effect of these relationships was shown in the highly significant positive relationship between all four sources of mathematics self-efficacy beliefs and the dimension, Proximity. This highly significant relationship may serve as verification of the earlier finding that reported the source, Performance Accomplishments, was shown not to have a significant relationship with mathematics self-efficacy beliefs. From Question 2, results revealed that both groups’ perceptions of the dimension, Influence, increased significantly from pre- to post scores; similarly, both groups’ perceptions of the dimension, Proximity, decreased significantly from pre- to post scores. These combined results seemed to indicate that students’ perception of cooperative communication within the mathematics classroom potentially enhances the strength of efficacy influence provided by their perception of successful mathematics accomplishments.

Two other interesting existing relationships were found in the All participants groups’ responses. The interpersonal behavior, Student Responsibility/Freedom, was found to have a significant inverse relationship to Vicarious Experiences and the dimension, Influence, was found to have a significant positive relationship to Vicarious Experiences. Again, these results seem to uphold findings reported in Questions 1 and 2. From Question 1, Vicarious Experience was the only source with a post mean score indicating a slight increase in students’ perception of its influence toward efficacy beliefs. From Question 2, both groups not only reported a
significant increase in participants’ and students’ perception of the dimension, Influence, but also reported a highly significant decrease in both groups’ perceptions of the interpersonal behavior, Student Responsibility/ Freedom. These findings indicated that for this population of ninth and tenth grade mathematics students as their perceptions of student responsibility and freedom within the mathematics classroom decreased, the strength of efficacy influence provided by modeling increased, as well as their perceptions of teacher-controlled classroom communication increased.

The All participants groups’ perceptions revealed a significant positive relationship between the interpersonal behavior, Student Responsibility/ Freedom, and MathSE. This result indicated that as perceptions of responsibility and freedom within the mathematics classroom increased, students’ efficacy beliefs toward future success in mathematics courses also increased. The AW students groups’ perceptions revealed two significant inverse relationships between TaskSE and both interpersonal behaviors, Student Responsibility/ Freedom and Strict. These results indicated that as perceptions of responsibility and freedom within the classroom decreased, and the more the teacher’s behavior was perceived as strict, students’ efficacy for mathematics tasks increased. One possible explanation for these seemingly contradicting findings lies in examining students’ interpretation of responsibility and freedom within the mathematics classroom. For example, one of the statements on the QTI that was used to measure students’ perceptions of Student Responsibility/Freedom read: “If we have something to say, she will listen.” If students’ interpreted that statement to mean, “If we have something to say about anything, she will listen,” then it is understandable why perceptions of student responsibility and freedom were shown to have an inverse relationship with mathematics task self-efficacy. Even the students realize that if everyone within the classroom is allowed time to talk about anything,
then there would be very little time for mathematics. Students’ with low mathematics self-efficacy often desire a diversion from participating in the mathematics lesson, and being able to control the classroom communication would allow them that opportunity. The other significant inverse relationship found between the interpersonal behavior, Strict, and mathematics task self-efficacy beliefs seemed to provide evidence that students need more responsibility and freedom within the mathematics classroom to increase their mathematics task self-efficacy.

**Question 4**

*How are Bandura’s four sources of self-efficacy addressed during one ninth grade’s Algebra I classroom instruction?*

*Performance Accomplishments*

The teaching beliefs associated with the source, Performance Accomplishments, were reconstructed from practical argument observations of the researcher instructing students on positive educational habits and a during a homework check. The first elicited was that if students improved their educational habits, the resulting improvement in grades would similarly improve students’ mathematics self-efficacy beliefs. This belief was validated through a study conducted by Zimmerman, Bandura, and Martinez-Pons (1992) where these authors concluded that academic self-efficacy influenced achievement directly and indirectly though students’ grade goals. Although this study’s quantitative results did not corroborate this belief, focus group interview responses seemed to provide corroborating evidence.

“Because it all count on your test scores where your confidence and how the teacher presents it for you to know how to do it.”
“Yeah, I agree to it because when you have a test grade, a good test grade, it shows that you understood what she taught and that you are kind of good in math and that brings your confidence up.”

These student responses verify the researcher’s teaching belief that students’ mathematics self-efficacy beliefs are most influenced by their successful mathematics performances.

The second elicited belief reconstructed from the video tape observations was that performance accomplishments or opportunities could be accomplished by allowing students to publicly demonstrate their homework problems. Bandura (1997) described performance accomplishments as developing from students’ perceptions that are formed by the pattern of success or failure of their previous performance attempts. Student focus group interview responses seemed to verify this interpretation of performance accomplishments.

“I feel like a good math student when I go to the board and work it out.”

“Because like if I get something right on the board and like, I go back to my desk. I have a big smile on my face and I think, ‘Hey, I’m smart,’ because I got mine right. Yeah, it makes me feel really good when I get it right like with no help and it be like okay so I feel confident when I go sit down.”

These excerpts from the focus group interviews seemed to echo Bandura’s description of performance accomplishments. Perception of the successful performance pattern is partially formed by working the problem at home and then demonstrating that work on the blackboard the next day. The next student’s response indicated that even unsuccessful demonstration can sometimes positively influence efficacy beliefs.

“Usually, when I do go to the board for some stuff and do get it wrong, she is going to always ask you to come to the board and show her how you got your answer…then she gonna
show you how to get the right answer. And it’s gonna show you how to get the correct answer and then it’s gonna show you how to do the rest of the problems right. And that makes you feel more confident.”

The researcher’s teaching belief that providing opportunities for successful performance accomplishments within the classroom is substantiated by the research studies that have shown performance accomplishments as exerting more efficacy influence than objective assessments (Lane, 2002; Lopez, Lent, Brown, & Gore, 1997).

*Vicarious Experiences*

The teaching beliefs associated with the source, Vicarious Experiences, were reconstructed from observations of the researcher modeling mental addition and correct mathematical verbiage for students. Both beliefs elicited from these observations were that modeling mental addition and correct mathematical verbiage would enhance their mathematics skill levels in algebraic problem solving. Vicarious Experiences have the most impact on those individuals that are inexperienced with the modeled task or who are not confident of their ability with that task (Bandura, 1986; Pajares, 1997). Students often come into Algebra I with below grade level mathematical skills and several mathematical misconceptions. The researcher’s teaching belief that providing vicarious experiences was an important objective within the mathematics classroom seemed to be confirmed by focus group interview responses.

“Because I get help from the teacher and when she’s showing me how to do my work, I’m like okay, I get this and I get that. And she’s like well that’s good that you get it and then as soon as the test gets here I make a passing grade on it. So I’m feeling more confident when she shows me stuff I learned.”
“Because if she presents it in a way that I can understand then I can do better on my homework and that helps me be successful with more homework and tests.”

“Like when she’s presenting it, if I do understand it then I’ll like write my notes and I study them and I’m like okay. So then when she turns around and gives us a test and I have a good grade…I, okay, it doesn’t register that I actually learned something until I get my test back. So I think the way she present it have big, big part in how I do on my homework and how I really do on the test grade.”

Other results within this study provided corroboration that vicarious experiences are important for the enhancement of mathematics self-efficacy beliefs. In both research groups, Vicarious Experience was the only source which post mean scores confirmed that students’ perceptions had increased over the semester. Another confirmation provided by previously reported results was the significant positive relationship found between Vicarious Experience and Mathematics Problem Solving Self-Efficacy (ProblemsSE). This result speaks directly to the teaching belief that was uncovered by the practical argument analysis.

One explanation for this increase in students’ perception of vicarious experience is supported by existing literature. Eccles, Midgley, and Adler (1984) suggested that vicarious experiences may increase in self-efficacy influential strength during students’ transitional periods. The majority of students that participated in this study were ninth grade students that were trying to adjust to the transition from the junior high school. A qualitative study of fifteen highly successful career women in the mathematical, scientific, and technological fields presented analysis of interview data which indicated that these participants considered vicarious experience and verbal persuasions as compelling efficacy building resources (Zeldin & Pajares, 2000).
Verbal Persuasions

The teaching beliefs associated with the source, Verbal Persuasions, were reconstructed from observations of the researcher giving students positive evaluative feedback on asking questions and paying attention during class. Several research studies have suggested that verbal positive and/or negative evaluations, particularly those received from teachers, are more important to some students (i.e. females and minorities) than previously believed (Klassen, 2004; Usher & Pajares, 2006; Zeldin & Pajares, 2000). Students that have not been successful in the mathematics classroom often develop learned helplessness. As a result, teachers should address every aspect of the learning process, including positive educational habits.

Focus group interview responses seemed to confirm that the researcher’s teaching beliefs associated with verbal persuasions were an important efficacy influence.

“Yeah, it gives you more confidence to ask questions. It show that she care about your ability to learn it.”

“Yeah, when she asks you to come to the board, and then you get it right and she’s like, ‘Oh, you got it right.’ That really makes me feel smart.”

“Like last year when we were teached it was like…I mean we’re kids, but we were taught like come to the class like you don’t know anything. But this year, she’s like, okay, I know you know this so, it builds this and this builds on this and it makes you feel like you know more, you feel smarter.”

Results from within this study have substantiated that verbal persuasions are considered to be an important self-efficacy influence. Both research groups reported the source, Verbal Persuasions, as the highest post mean score within the descriptive statistical analysis. Verbal Persuasions was also the only source to be significantly related to All participants’ and AW
students’ mathematics self-efficacy beliefs. These results did not contradict former research that Usher and Pajares (2006) reported verbal persuasions accounted for a greater unique variance than did performance accomplishments for White females and African American students within their investigation. Indo Canadian students (South Asian immigrants) indicated in Klassen’s (2004) study that their self-efficacy beliefs were more strongly influenced by verbal persuasion and vicarious experiences than did the nonimmigrant Anglo Canadian students. Zeldin and Pajares (2000) found in their qualitative study of highly successful career women that verbal persuasions were considered to be a compelling resource for their mathematics self-efficacy beliefs.

The complementary nature of the findings between this qualitative inquiry with their own quantitative analyses propelled Usher and Pajares (2006) to recommend that it would “be valuable to discover how students select, attend to, and recall the persuaders who exercise the deepest formative influence on them” (p. 139, italics added). Specifically, students are inclined to trust the evaluations of their mathematical abilities from the people they deem to be skilled in those activities or expert in mastering those activities (Bandura, 1997). Presently, measurement instruments disregard students’ trust of the individual(s) responsible for those mathematical ability evaluations. Measures of verbal persuasion that neglect this factor do not provide a complete picture of its true influential nature (Usher & Pajares, 2008). From the literature and the results within this study, teacher interpersonal behaviors perceived by both groups within the mathematics classroom have been shown to be an important factor when considering the “persuaders who [may] exercise the deepest formative influence…” (Usher and Pajares, 2006, p. 139, italics added).
The teaching beliefs associated with the source, Emotional-Physiological States, were reconstructed from videotaped observations of the researcher allowing students extra time in note-taking and addressing students’ fear of fractions. These reconstructions indicated that the researcher believes students’ perception of ability can be negatively affected by fear and anxiety, but also their perceptions can be positively affected by a student’s interest and liking for mathematics. Focus group interview responses seemed to validate the teaching belief that positive and negative efficacy influences can be formed from students’ emotional physiological states.

“Like when she’s teaching a problem and everybody gets it but you. You’re the only person that don’t get the problem, that’ll make you feel…And she’ll be like, don’t be afraid to raise your hand if you don’t know it. But it’s like, I don’t understand and people look at you like you don’t understand; it’s so easy, but, if you don’t understand, you just don’t. And it’s kind of scary to ask a question. I mean, she’s very inviting, like ask a question if you don’t understand. But, classmates are like, you don’t understand it, it’s so easy…And that makes you feel dumb.”

“I think sometimes people think I’m smarter than I am. This is how I feel personally. Other students are like, can you help me with this? And I’m like I really don’t know how to do this. Well you look like it. And I’m like, I might look like I know how to do it, but I really don’t. I think…I’m smart, but I’m not a genius, like some people in math, because I was like in sixth grade, fifth grade…math was nothing and then was like I know math; I’ll do it, you know. People like can you help me, I help you all the time. But now, I’m like I can’t help myself…I think it’s…like I’m not as interested in math as I use to be. I use to love math. Well I mean, I don’t care as much, I mean I don’t love it as much as I used to.”
These focus group responses indicated that anxiety and lack of emotional connection to the subject had a negative influence toward mathematics self-efficacy beliefs. Usher and Pajares (2006) found that the lower-ability students within their study attributed emotional-physiological states as a predictive factor of their mathematics self-efficacy beliefs. Matsui, Matsui and Ohnishi (1990) recognized students’ lack of anxiety as a uniquely contributing factor to undergraduates’ mathematics self-efficacy beliefs. Contradicting those findings along with the findings from this study, Lopez and Lent (1992) concluded that there was no significant influence toward efficacy beliefs from emotional-physiological states. The following interview responses seemed to indicate that students’ emotional connections to mathematics were positive influences toward their mathematics self-efficacy beliefs.

“Because if she’s boring, then you’d be like it’s pointless and I don’t wanna try so you just fail. But if she’s interesting, you’ll be like maybe I can pass math if I pay attention, you know.”

“Well, as far as I can say, she’s just doing a good job teaching. She has taught me a lot of stuff and more than I learned last year. Grades have been improving, I’m making more friends, and I’m starting to love math.”

This study has found other results to further validate the teaching belief that students’ emotional connections to mathematics should be attended within the mathematics classroom. Participants’ and students’ perceptions of Emotional-Physiological States from the SMSES, as an influential source of their self-efficacy beliefs, were shown to have significantly decreased during the academic semester. Both research groups’ efficacy for future success in mathematics courses were shown to have the lowest post mean scores. The combination of these results along with the significant positive relationship found to exist between Emotional-Physiological States and
students’ efficacy for future success in mathematics led to the following conclusion: Students’ decreased emotional connections to mathematics had negatively affected their efficacy beliefs toward future success in mathematics. Viewing the positive side of emotional-physiological states as influential factors in students’ mathematics self-efficacy beliefs has been addressed by other researchers.

Bandura (1997) suggested that when emotional-physiological states are interpreted as challenging experiences, then self-efficacy beliefs could be positively influenced. Usher and Pajares (2008) remarked that a positive mood accompanied by academic success could provide increases in personal efficacy beliefs. Unfortunately, the positive dimensions of emotional physiological states have not yet been adequately assessed by quantitative measures (Usher & Pajares, 2008).

Limitations and Recommendations

Limitations of the Study

This study was limited to ninth and tenth grade students in a single rural high school. The findings of this study may not generalize to student populations in urban or even other rural schools where demographics and student histories may differ. This study was also limited to the beliefs, opinions, and perceptions of a relatively small population of students (N=97). Larger populations could show quite different quantitative results from those presented within this study.

The use of surveys to measure students’ perceptions of mathematics self-efficacy beliefs, teacher classroom interpersonal behaviors, and the sources of mathematics self-efficacy beliefs may have resulted in response bias. Some students may have answered these surveys in ways that they believed their teachers or the researcher would want which would have created bias.
Although focus group interviews were conducted by a teacher other than the researcher, students were videotaped during these interviews and knew that the researcher (their mathematics teacher) would view those tapes. This could have biased the students’ responses toward what the researcher wanted to hear rather than how they felt about the various issues they were asked to discuss. Analysis of focus group interview responses could have displayed the researcher’s bias in analyzing her own students within her own classroom.

This study was conducted during one semester of an academic year. Although there is merit to discover how perceptions and beliefs of students change over the short term (i.e. block scheduling), a longer investigation may have produced different results. For example, students’ perceptions of teacher classroom interpersonal behaviors may not have shown significant changes had the pre- and post surveys been administered at the end of the first semester and then again at the end of the second semester.

**Recommendations for Future Research**

Discovering whether or not students’ perceptions of teacher classroom interpersonal behaviors significantly change during the academic year and whether those changes in perception are related to mathematics self-efficacy beliefs could provide valuable information to teacher education programs. The many significant relationships found to exist between Bandura’s (1997) four sources of self-efficacy and teacher classroom interpersonal behaviors require further investigation to illuminate how these relationships may affect mathematics self-efficacy.

1) This study should be replicated using a much larger population of students from across rural and urban districts to determine whether the same relationships found in this study exist.
2) Further research is needed to determine whether students’ responses within this study would be similar to students who are investigated by an outside researcher. The response bias that may have existed in this study could be confirmed or contradicted if another study conducted by an outside researcher found similar responses from a larger sample.

3) Additional insights regarding efficacy influences might be gained by a longitudinal study that extends the investigative focus of this study.

Chapter 5 Summary

This chapter presented the researcher’s interpretation of the findings from quantitative and qualitative analyses. Aligning with existing literature, analysis of focus group interviews revealed students’ perception of performance accomplishments as the most influential source toward their mathematics self-efficacy beliefs (Hampton, 1998; Klassen, 2004; Matsui, Matui, & Ohnishi, 1990). In contrast, quantitative analysis revealed that Verbal Persuasions were considered the most influential efficacy source and was significantly related to participants’ and students’ beliefs toward future success in mathematics courses. The practical argument analysis revealed that the researcher’s teaching beliefs were aligned with the four sources of self-efficacy and verification of those beliefs were provided survey results and focus group responses.


den Brok, P. (2001). *Teaching and student outcomes. A study on teachers’ thoughts and actions from an interpersonal and a learning activities perspective*. Utrecht: W. C. C.


APPENDIX A: PARENT/STUDENT CONSENT AND ASSENT FORMS
October 22, 2009

Dear Parent or Guardian,

While teaching at Monroe County High School, I have also been pursuing my doctoral degree in Secondary Education/Mathematics from the University of Alabama. In order to complete the requirement of this degree, I must complete a full research study. I have chosen to conduct a study that will include all ninth and tenth grade mathematics students. The purpose of my study is to investigate the teacher-student relationship and its association to students’ mathematics self-efficacy beliefs, (i.e. their belief in their ability to perform specific mathematical tasks). I hope to learn from this self-study that student’s self-efficacy beliefs will be positively affected through the teacher-student relationship.

Your child was selected as a possible participant because he/she is enrolled in one of the ninth or tenth grade mathematics classes for the 2008-2009 school year. For those students that are not enrolled in one of my Algebra 1A classes, I will only ask that they complete three surveys at the beginning of the semester and again at the end of the semester. This study is the final requirement in my doctoral program at the University of Alabama. If you decide to allow your child to participate, I will be video taping certain classes bi-weekly and others only three times for the duration of this study. All of the participating students will be asked to complete three surveys. Students enrolled in my three Algebra 1A classes will be video-taped and asked to complete pre-test questionnaires before every regular Algebra test. A selected group of students will be asked to participate in focus group interviews. The entire study is expected to last approximately 8-10 weeks. I am studying my teaching and the students’ perception of my teaching behavior, so the instruction of Algebra 1A coursework will not be affected by this investigation.

Any information obtained in connection with this study that can be identified with your child will remain confidential and will be disclosed only with your permission. In any written reports or publications, no one will be identified or identifiable and only aggregate data will be presented. Only I and my university advisor will view the video tapes and all surveys and questionnaires will be distributed in such a way as to allow your child’s responses to remain anonymous. The focus group interviews will be conducted by a research assistant that will video/audiotape their responses. Again, all students’ responses will be kept confidential by me, my advisor, and by the research assistant.

The participation of your child in this study is very important. This study will benefit society and education in identifying new ways in which teachers can positively affect students’ mathematics self-efficacy beliefs, which in turn could lead to more successful mathematics students. After carefully reading this consent form, please indicate whether or not you give permission for your child to participate in this study. This participation is strictly voluntary. Your child’s grades will not be affected in any way by participating or not participating. You or your child may elect to discontinue their participation in this study at any time during the study without penalty or loss of benefits to which he or she is otherwise entitled.

Sincerely,
Amanda G. White

Please check the box below that you are consenting to allow your child to participate in the above described study:

☐ I GIVE permission for my child to participate in the above described study and give permission for my child’s data to be reported confidentially in the study without any association with his/her name.

OR, check the box below to indicate your refusal to give consent:

☐ I do NOT give permission for my child to participate in the above described study.

_______________________________________ (Signature of parent or guardian) __________ (date)

STUDENT’S SECTION

I have read the information above about the research study involving my Algebra 1A class.

Please check the box below to indicate that you are consenting to participate in the above described study:

☐ I AM willing to participate in the above described study and I give permission for my data to be reported privately in the study. I understand that my name will not be included anywhere in the report and my data will not be reported with my name.

OR, check the box below to indicate that you are unwilling to participate in the described study:

☐ I am NOT willing to participate in the above described study.

_______________________________________ (Signature of minor student) ___________ (date)

NOTE: If you have any questions about the study, you may contact me (contact information at the top of the first page of this letter), or my advisor at The University of Alabama (Dr. Craig Shwery, Assistant Professor of Curriculum and Instruction, College of Education, at cshwery@bamaed.ua.edu).
APPENDIX B: MATHEMATICS SELF-EFFICACY SCALE-REVISED
Directions: Suppose that you were asked the following math questions in a multiple choice form. Please indicate how confident you are that you would give the correct answer to each question.

PLEASE DO NOT ATTEMPT TO SOLVE THE PROBLEMS.

YOU WILL NOT BE ASKED TO SOLVE THESE PROBLEMS AFTER YOU COMPLETE THIS QUESTIONNAIRE.

Please use the following scale:

1  2  3  4  5  6
Not at all confident  Completely confident

1. In a certain triangle, the shortest side is 6 inches. The longest side is twice as long as the shortest side, and the third side is 3.4 inches shorter than the longest side. What is the sum of the three sides in inches?

2. ABOUT how many times larger than 614,360 is 30,668,000?

3. There are three numbers. The second is twice the first and the first is one-third of the other number. Their sum is 48. Find the largest number.

4. Five points are on a line. T is next to G. K is next to H. C is next to T. H is next to G. Determine the positions of the points along the line.

5. If \( y = 9 + \frac{x}{5} \), find \( x \) when \( y = 10 \).

6. A baseball player got two hits for three times at bat. This could be represented by \( \frac{2}{3} \). Which decimal would most closely represent this?

7. If \( P = M + N \), then which of the following will be true?
   I. \( N = P - M \)
   II. \( P - N = M \)
   III. \( N + M = P \)

8. The hands of a clock form an obtuse angle at ____ o'clock.

9. Bridget buys a packet containing 9-cent and 13-cent stamps for $2.65. If there are 25 stamps in the packet, how many are 13-cent stamps?
10. On a certain map, 7/8 inch represents 200 miles. How far apart are two towns whose distance apart on the map is 3 1/2 inches?

11. Fred's bill for some household supplies was $13.64. If he paid for the items with a $20 bill, how much change should he receive?

12. Some people suggest that the following formula be used to determine the average weight for boys between the ages of 1 and 7: \( W = 17 + 5A \) where \( W \) is the weight in pounds and \( A \) is the boy's age in years. According to this formula, for each year older a boy gets, should his weight become more or less, and by how much?

13. Five spelling tests are to be given to Mary's class. Each test has a value of 25 points. Mary's average for the first four tests is 15. What is the highest possible average she can have on all five tests?

14. \( 3 \frac{4}{5} - \frac{1}{2} = _____ \)

15. In an auditorium, the chairs are usually arranged so that there are \( x \) rows and \( y \) seats in a row. For a popular speaker, an extra row is added, and an extra seat is added to every row. Thus, there are \( x + 1 \) rows and \( y + 1 \) seats in each row, and there will be \( (x + 1) \) and \( (y + 1) \) seats in the auditorium. Multiply \( (x + 1) \) (\( y + 1 \)).

16. A ferris wheel measures 80 feet in circumference. The distance on the circle between two of the seats is 10 feet. Find the measure in degrees of the central angle SOT whose rays support the two seats.

17. Set up the problem to be done to find the number asked for in the expression "six less than twice 4 5/6"?

18. The two triangles shown on the right are similar. Thus, the corresponding sides are proportional, and \( \frac{AC}{BD} = \frac{XZ}{YZ} \) if \( AC = 1.7 \), \( BC = 2 \), and \( XZ = 5.1 \), find \( YZ \).
Directions: How much confidence do you have that you are able to successfully perform each of the following tasks?

1. Add two large numbers (e.g., 5739 + 62543) in your head. 1 2 3 4 5 6
2. Determine the amount of sales tax on a clothing purchase. 1 2 3 4 5 6
3. Figure out how much material to buy in order to make curtains. 1 2 3 4 5 6
4. Determine how much interest you will end up paying on a $675 loan over 2 years at 14 3/4% interest. 1 2 3 4 5 6
5. Use a scientific calculator. 1 2 3 4 5 6
6. Compute your car's gas mileage. 1 2 3 4 5 6
7. Calculate recipe quantities for a dinner for 41 when the original recipe is for 12 people. 1 2 3 4 5 6
8. Balance your checkbook without a mistake. 1 2 3 4 5 6
9. Understand how much interest you will earn on your savings account in 6 months, and how that interest is computed. 1 2 3 4 5 6
10. Figure out how long it will take to travel from City A to City B driving 55 mph. 1 2 3 4 5 6
11. Set up a monthly budget for yourself. 1 2 3 4 5 6
12. Compute your income taxes for the year. 1 2 3 4 5 6
13. Understand a graph accompanying an article on business profits. 1 2 3 4 5 6
14. Figure out how much you would save if there is a 15% markdown on an item you wish to buy. 1 2 3 4 5 6
15. Estimate your grocery bill in your head as you pick up items. 1 2 3 4 5 6
16. Figure out which of two summer jobs is the better offer; one with a higher salary but no benefits, the other with a lower salary plus room, board, and travel expenses. 1 2 3 4 5 6
17. Figure out the tip on your part of a dinner bill split 8 ways. 1 2 3 4 5 6
18. Figure out how much lumber you need to buy in order to build a set of bookshelves.

**Page 4 of 4**

Directions: Please rate the following college courses according to how much confidence you have that you could complete the course with a final grade of "A" or "B." Circle the appropriate response on the 5-point scale according to the following guidelines.

Use the following scale:

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<td><strong>Completely confident</strong></td>
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<tr>
<td>8. Philosophy</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>9. Geometry</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>10. Computer science</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>11. Accounting</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>12. Zoology</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>13. Algebra I</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>14. Trigonometry</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>15. Advanced calculus</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>16. Biochemistry</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>
APPENDIX C: SOURCES OF MATHEMATICS SELF-EFFICACY SCALE
Sources of Mathematics Self-Efficacy Scale

Originally published in:


*This scale was reworded to accommodate the age group of this study. Permission from Dr. Lent was requested and received via email.
**Directions:** Using the scale listed below, circle the number which represents your level of agreement.

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I usually made high scores on my achievement tests in mathematics.</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>2. My favorite teachers were usually math teachers.</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>3. My friends have discouraged me from taking math classes.</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>4. I get a sinking feeling when I think of trying hard math problems.</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>5. I received good grades in my high school math classes.</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>6. While growing up, many of the adults I most admired were good at math.</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>7. Other people generally see me as being poor at math.</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>8. I would be upset if I had to take more math courses.</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>9. In math classes, I rarely get the answer before my classmates do.</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>10. Most friends of mine did poorly in high school math courses.</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>11. I get really uptight while taking math tests.</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Strongly Disagree</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>------------------</td>
</tr>
<tr>
<td>12. My adviser has singled me out as having good math skills and has encouraged me to take college math courses.</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>13. Among my friends I’m usually the one who figures out math problems (e.g. like dividing up a restaurant bill).</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>14. My parents have encouraged me to be proud of my math ability.</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>15. My mind goes blank and I am unable to think clearly when working mathematics.</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>16. I have received special awards for my math ability.</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>17. My career role models (i.e., those people I’d like to be like) are mostly in fields that do not involve math.</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>18. My friends have encouraged me to take higher level math classes.</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>19. Math has always been a very difficult subject for me.</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Strongly Disagree</td>
<td>Strongly Agree</td>
</tr>
<tr>
<td>---</td>
<td>------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>20.</td>
<td>I almost never get uptight while taking math tests.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>21.</td>
<td>My friends tended to avoid taking high school math courses.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>22.</td>
<td>My parents are not very good at math.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>23.</td>
<td>Teachers have discouraged me from pursuing occupations that require a strong math background.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>24.</td>
<td>I am rarely able to help my classmates with difficult math problems.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>25.</td>
<td>People I look up to (like parents, friends, or teachers) are good at math.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>26.</td>
<td>I usually don’t worry about my ability to solve math problems.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>27.</td>
<td>I was often encouraged to join clubs in high school which required math ability (i.e. Math Club, Computer Club).</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>28.</td>
<td>I took fewer high school math courses than most other students did.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>29.</td>
<td>Some of my closest high school friends excelled on the math part of their college entrance exams.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td></td>
<td>Strongly Disagree</td>
<td>Strongly Agree</td>
</tr>
<tr>
<td>---</td>
<td>-------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>30.</td>
<td>Mathematics makes me feel uneasy and confused.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>31.</td>
<td>People I look up to have told me not to consider a math-related major.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>32.</td>
<td>When I come across a tough math problem, I work at it until I solve it.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>33.</td>
<td>Many of the adults I know are in occupations that require a good understanding of math.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>34.</td>
<td>I have usually been at ease during math tests.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>35.</td>
<td>I have always had a natural talent for math.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>36.</td>
<td>High school teachers rarely encouraged me to continue taking math classes.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>37.</td>
<td>Mathematics makes me feel uncomfortable and nervous.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>38.</td>
<td>Many of my friends are in, or intend to enter, fields that do not require strong math skills.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>39.</td>
<td>My parents have encouraged me to do well in math.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>40.</td>
<td>I have usually been at ease in math classes.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Source</td>
<td>Questions</td>
<td></td>
</tr>
<tr>
<td>------------------------------</td>
<td>----------------------------</td>
<td></td>
</tr>
<tr>
<td>Performance Accomplishments</td>
<td>1, 5, 9, 13, 16, 19, 24, 28, 32, 35</td>
<td></td>
</tr>
<tr>
<td>Vicarious Information</td>
<td>2, 6, 10, 17, 21, 22, 25, 29, 33, 38</td>
<td></td>
</tr>
<tr>
<td>Verbal Persuasion</td>
<td>3, 7, 12, 14, 18, 23, 27, 31, 36, 39</td>
<td></td>
</tr>
<tr>
<td>Emotional Arousal</td>
<td>4, 8, 11, 15, 20, 26, 30, 34, 37, 40</td>
<td></td>
</tr>
</tbody>
</table>

| Reversed items               | 3, 4, 7, 8, 9, 10, 11, 15, 17, 19, 21, 22, 23, 24, 28, 30, 31, 36, 37, 38 |
APPENDIX D: QUESTIONNAIRE ON TEACHER INTERACTION
The Questionnaire on Teacher Interaction (American version)  
(Wubbels & Levy, 1991)

This questionnaire asks you to describe your teacher's behavior. Your cooperation can help your teacher improve her instruction. DO NOT WRITE YOUR NAME, for your responses are confidential and anonymous. This is NOT a test. Please answer each question truthfully. Your teacher needs truthful feedback in order to improve her instruction. Your grade will not be affected by your answers on this questionnaire.

QUESTIONNAIRE

On the next few pages you'll find 64 sentences. For each sentence on the questionnaire find the same number on the answer sheet and darken the circle you think most applies to the teacher of this class. Please use only a #2 pencil.

For example:

<table>
<thead>
<tr>
<th>Never</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
</tr>
</tbody>
</table>

She expresses herself clearly

If you think that your teacher always expresses herself clearly, darken letter E on your answer sheet. If you think your teacher never expresses herself clearly darken letter A. You can also choose letters B, C or D, which are in between. If you want to change your answer after you’ve darkened a circle please erase completely. Please use both sides of the answer sheet. Thank you for your cooperation.
<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>She is strict.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>2.</td>
<td>We have to be silent in her class.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>3.</td>
<td>She talks enthusiastically about her subject.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>4.</td>
<td>She trusts us.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>5.</td>
<td>She is concerned when we have not understood her.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>6.</td>
<td>If we don't agree with her we can talk about it.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>7.</td>
<td>She threatens to punish us.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>8.</td>
<td>We can decide some things in his class.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>9.</td>
<td>She is demanding.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>10.</td>
<td>She thinks we cheat.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>11.</td>
<td>She is willing to explain things again.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>12.</td>
<td>She thinks we don't know anything.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>13.</td>
<td>If we want something she is willing to cooperate.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>14.</td>
<td>Her tests are hard.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>15.</td>
<td>She helps us with our work.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>16.</td>
<td>She gets angry unexpectedly.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>17.</td>
<td>If we have something to say she will listen.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>18.</td>
<td>She sympathizes with us.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>19.</td>
<td>She tries to make us look foolish.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>20.</td>
<td>Her standards are very high.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
</tbody>
</table>
21. We can influence her.
   never always
   A B C D E

22. We need her permission before we speak.
   never always
   A B C D E

23. She seems uncertain.
   never always
   A B C D E

24. She looks down on us.
   never always
   A B C D E

25. We have the opportunity to choose assignments which are most interesting to us.
   never always
   A B C D E

26. She is unhappy.
   never always
   A B C D E

27. She lets us fool around in class.
   never always
   A B C D E

28. She puts us down.
   never always
   A B C D E

29. She takes a personal interest in us.
   never always
   A B C D E

30. She thinks we can't do things well.
   never always
   A B C D E

31. She explains things clearly.
   never always
   A B C D E

32. She realizes when we don't understand.
   never always
   A B C D E

33. She lets us get away with a lot in class.
   never always
   A B C D E

34. She is hesitant.
   never always
   A B C D E

35. She is friendly.
   never always
   A B C D E

36. We learn a lot from her.
   never always
   A B C D E

37. She is someone we can depend on.
   never always
   A B C D E

38. She gets angry quickly.
   never always
   A B C D E

39. She acts as if she does not know what to do.
   never always
   A B C D E

40. She holds our attention.
   never always
   A B C D E

41. She's too quick to correct us when we break a rule.
   never always
   A B C D E

42. She lets us boss her around.
   never always
   A B C D E

43. She is impatient.
   never always
   A B C D E

44. She is not sure what to do when we fool around.
   never always
   A B C D E

PLEASE CONTINUE ON THE NEXT PAGE
45. She knows everything that goes on in the classroom.  
46. It's easy to make a fool out of her.  
47. She has a sense of humor.  
48. She allows us a lot of choice in what we study.  
49. She gives us a lot of free time in class.  
50. She can take a joke.  
51. She has a bad temper.  
52. She is a good leader.  
53. If we don't finish our homework we're scared to go to her class.  
54. She seems dissatisfied.  
55. She is timid.  
56. She is patient.  
57. She is severe when marking papers.  
58. She is suspicious.  
59. It is easy to pick a fight with her.  
60. Her class is pleasant.  
61. We are afraid of her.  
62. She acts confidently.  
63. She is sarcastic.  
64. She is lenient.

never  always
A B C D E

THANK YOU!
Pre-Test Questionnaire

Choose the statement below that best describes how you feel about the upcoming test. If none of the statements describe your feelings, then describe your feelings on the lines beside other. Please use complete sentences.

1. I am confident that I will be able to solve one-step equations correctly.
2. I am somewhat confident that I will be able to solve one-step equations correctly.
3. I am not confident at all that I will be able to solve one-step equations correctly.

Other __________________________________________________________

Circle the items below that best describe WHY you feel this level of confidence or non-confidence.

1. I always do well on these math tests.
2. I usually don’t do well on these math tests.
3. I do not get nervous at all when taking math tests.
4. I usually get nervous when taking these math tests.
5. Others (teacher, parent, and or friends) have told me that I am good at solving one-step equations.
6. Others (teacher, parent and or friends) have told me that I am not good at solving one-step equations.
7. Most of my friends are able to solve one-step equations correctly.
8. Most of my friends are not good at solving one-step equations.
9. My parents are really good at math.
10. My parents are not good at math.

11. I have had good homework grades all week.

12. I have struggled with the homework all week.

13. Other: ____________________________________________________
    ______________________________________________________

Choose the items from the list below that best describes your experiences in class this week.

1. The class could not discuss the lesson because the teacher required us to stay quiet.

2. The teacher noticed when I was confused about the lesson.

3. I was able to get assistance from the teacher when I asked for help.

4. The teacher was willing to answer the same question several times.

5. When asked, the teacher agreed to let students work out problems on the board.

6. The teacher got impatient with us because we found a mistake in a problem she worked on the board.

7. The teacher lectured the whole class for 15 minutes because some of the students did not do their homework.

8. The teacher looked irritated when someone told her that they still did not understand.

9. Other: ____________________________________________________
    ______________________________________________________
APPENDIX F: STUDENT DEMOGRAPHIC FORM
Demographic Information Form

Name __________________________________________________________

Address ________________________________________________________

Grade ________ Mathematics Class _____________________________

Mathematics Teacher _____________________________________________

Age ______________ Gender : M or F (circle one)

Race : African-American Caucasian Asian-American Latino (circle one)

Student Identification Code _______________________________________